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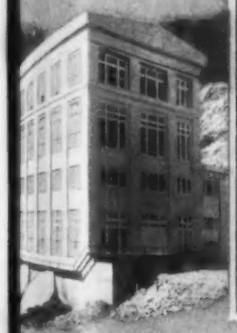

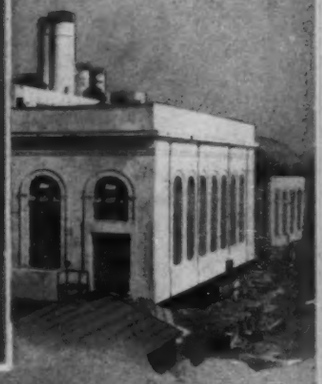

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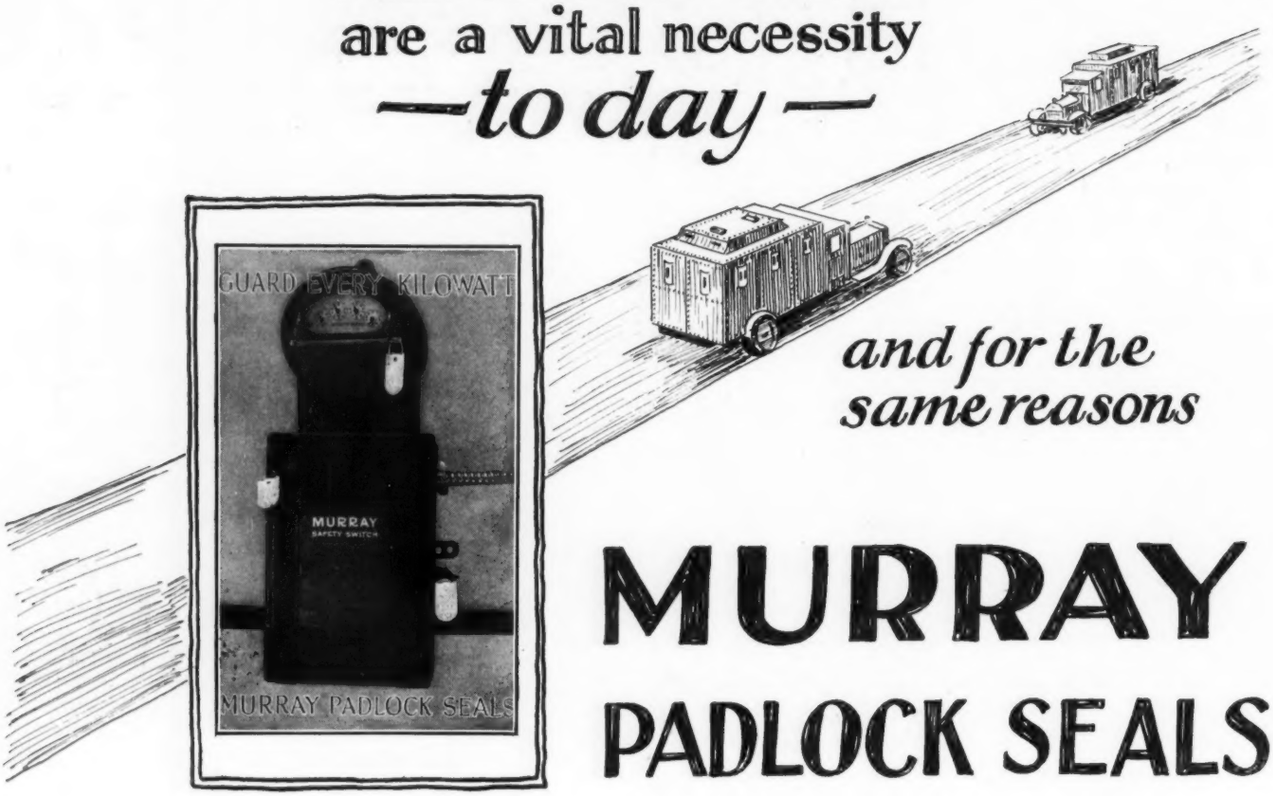

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Quantitative Measures of Progress

THE staff of the ELECTRICAL WORLD will present an unusually good and complete review and statistical issue to the industry on January 1. A series of statistical articles and tables will give the industry a quantitative measure of the progress made in 1926. Energy generated, sold and interchanged, growth in number of customers, utility financing, analyses of commercial efforts and many other topics will be discussed on the basis of authoritative data submitted by the industry.

Budget expenditures for 1927, a careful survey of trends in all branches of the industry, a critical discussion of industry problems and a complete résumé of operations will give added value to the issue.

The editorial staff of the ELECTRICAL WORLD has worked for two months or more in checking and summing up about 2,000,000 items received on questionnaire sheets. It has recorded and tabulated these data and interpreted the meaning of the resultant totals. Telegrams at the last minute have brought complete returns for 1926 and expected budget expenditures for 1927.

In the 80 pages of the January 1 issue readers will find an example of editorial service which requires a large staff, painstaking effort over a long period, a full degree of co-operation from the industry, and facilities for prompt dramatization and publication of material while it is fresh. The staff hopes that the concrete result will give service value sufficient to justify the work and expense involved.

Annual Statistical and Review Issue

JANUARY 1

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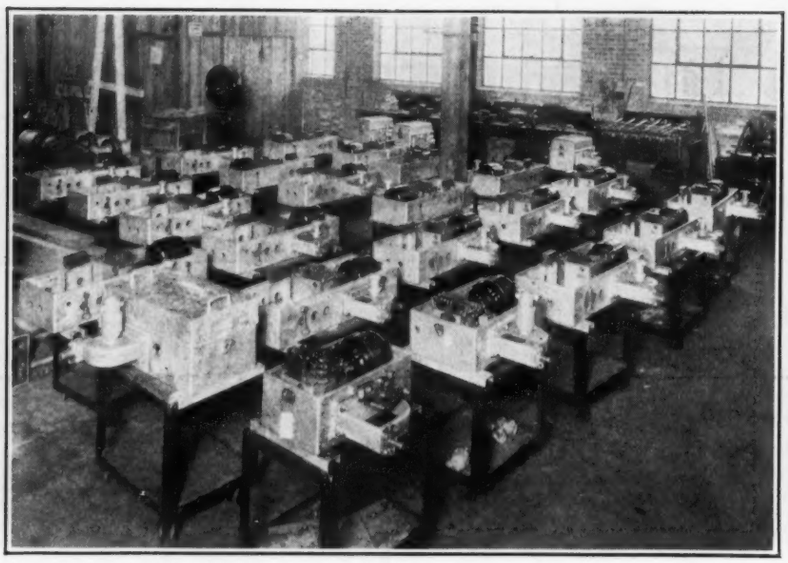

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Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 88 — *New York, Saturday, December 25, 1926* — NUMBER 26

Honor to James H. McGraw

THIS country possesses many men who have rendered signal service to the state and to society. Did these individuals live in England, that nation would bestow on them a title of nobility; France would decorate them with the insignia of the Legion of Honor, Italy might make them Knight Grand Officers of the Crown, Japan adorn them with the Order of the Rising Sun, and so on. But in the United States there is no honor or distinction provided by the government for exceptional public service. The only recognition American genius and ability receive resides in the medals and diplomas conferred by professional and engineering societies, or in banquets rendered in response to a desire fittingly to honor and fête men deserving of recognition.

A week ago a dinner was tendered to James H. McGraw at New York in recognition of his lasting contribution to the progress of engineering and industry. In view of his publishing ideals and the achievements which have crowned his forty-odd years of labor as a publisher of technical, economic and business literature, there is general agreement that the honor thus bestowed on Mr. McGraw was well justified. It would be easy to demonstrate the enormous part he has played in advancing science and industry. Devoted to service and never content with anything short of the best, his publications—if the apparent self-laudation may be pardoned—stand out over and above all other publications of their kind in the world. This of itself is distinction and honor enough; but we are particularly pleased, and so also is Mr. McGraw, that so many men in professional and business life have seen and recognized so generously and sincerely the excellence of the periodicals he publishes and the untiring, earnest and high-motived endeavor of the man to whom their success is pre-eminently due.

Local Initiative and Holding Companies Still Compatible

THERE is no substitute for the experience of the men actually in charge of operation of any given property. On the other hand, these men are naturally limited in viewpoint because they cannot take the time to keep in broad contact with industry developments. One of the several valuable functions of a large holding company is to maintain that contact and devise ways and means to combine the knowledge so gained with the local operating experience so that errors due to the limited experience of local men and the lack of local experience on the part of the holding-company men can be avoided. On the same principle, purchasing cannot be concentrated in the hands of one man who buys on price alone. In many cases initial cost may be purely secondary. The final decision must usually rest in the hands of the operating force and be based on engineering and operating considerations and the ability of the property to earn a return on the proposed investments or pay the increased operating expenses created by the purchases. There is no substitute for "property management" in this respect.

Some electric light and power holding companies have always known, and most others have learned the fact by experience, that absentee management is no more a successful possibility than is absentee landlordism. Both wreck themselves in the long run. Except in isolated instances, there are, fortunately, no signs that there will be any serious effort to establish absentee management in respect to purchasing or any other phases of the light and power industry.

Improving Safety Work in Utilities

ACCIDENT prevention in modern industry is so vast a subject that at times it looks formidable to electric light and power company executives anxious to achieve the best possible record on their own properties. As in many other activities, however, the key to success lies in competent and alert organization. Large companies must specialize and smaller ones generalize in this work; that is, the study of safety problems must be adapted to the range of duties and interests of the personnel. We cannot expect the boiler foreman to be greatly interested in the hazards of line construction and maintenance on a large property, but in smaller utilities, where superintendents and engineers have a broader coverage in personal supervision of work in plant and field, safety interest must be "stretched more" per man, with perhaps more concentration on the problem by executives and their advisory staffs and less by the "non-coms"—to borrow an army term.

In some companies safety engineering is now in full and regular standing as a routine activity. Every new plant for a generating station, substation, office, garage or what not is surveyed from this angle before a stroke of field work is done, on the theory that safety begins on the drafting table. Regular committee meetings are also held to discuss accidents and their prevention, and departments are organized on a competitive basis to sustain interest. All this technique need not be repeated here, but out of the field are constantly coming the lessons of experience and the rewards of analysis. Bonuses for non-accident records over stated periods help, and friendly rivalry between departments has accomplished wonders, sometimes completely reversing the records of line crews or other groups whose interest has been challenged and kept alert by vigorous competition, graphic illustrations, skillful direction and hospitality to suggestions, emanating from them. To carry this

work still further is a fascinating task. The relation between safety and health deserves far more investigation than it has had thus far in many companies. Employees in subnormal physical condition are for that reason poorer accident risks, and there is a close relationship between conditions of home life and accident hazards while men are at work that wise and sympathetic executives are pondering more and more.

Another vitally important matter is the study of work organization in plant and field to fit better the capacities of particular employees, including a better definition of responsibility for departmental supervision on detailed jobs and the prevention of accidents caused by attempts of unqualified men to do work outside their training, especially when "loaned" by one department to another. Still another field for progress is intercompany co-operation in safety work as between communication and power utilities. Joint inspections and critical surveys on a sort of "exchange-of-pulpit" basis are also on the horizon. There is a gratifying development of interest in all this work through the incentive to prevent suffering and overcome obstacles, and while the total lost time per employee does not seem to fall off much from the present order of between one and two days per year as noted in one large group of properties, the time lost from serious accidents is diminishing. There is room in many cases for keeping better data, and especially more photographic and sketch information on safety practice *per se*, but on the whole progress in this important field is more than encouraging.

Selling Adequate House Wiring

ADEQUATE house wiring is largely a question of education and selling. It requires a local organization in each community armed with facts that are convincing to contractors, architects and the public. A recent experience is typical of the situation. In a comparatively small city all contractors, architects and the municipal inspector were invited to meet with a league representative and an underwriters' representative. Nearly all those invited came to the meeting, and the league man opened the program by getting the local group to draw up a plan for wiring a small house in what it considered an adequate manner. Actual plans were used and the group of men showed no hesitancy in agreeing upon the wiring outlets. When they had finished, the league agent added the wiring and outlets called for under the "red seal" plan. Each additional outlet was discussed thoroughly, and all present agreed upon the extra wiring before it was added to the plans. When the theoretical house was completely wired, the wirers were surprised to find that they had agreed upon an installation as adequate which was about 30 per cent greater than their own conception of a maximum installation. In their ordinary plans they had not considered the convenience of home dwellers and had not known of certain new wiring equipment and devices that would add to the desirability of the residence.

Then the underwriters' representative discussed code wiring. Only about one per cent of those present had a copy of the code, and the large majority knew little of the recent changes in code rules. All had questions to ask regarding interpretation of the clauses in the code. After three or four hours of discussion and comment the local men left the meeting with a new conception of adequate wiring and were enthusiastic about the help they had received. This instance is cited as a typical demonstration of the necessity for bringing the message of adequate wiring to the men who do the planning and the wiring of homes. The message should be conveyed in a personal manner and should be followed up at intervals. The local electrical league in each community is a splendid agency for heading the work.

Processing of Fuels as a Utility Function

SO FAR it does not appear that processing of coal is going to provide a power-plant fuel which will permit any marked economies in combustion efficiency, steam-plant investment, maintenance or operating expense. Therefore the determination of whether electric service utilities shall process their fuels for by-products is a combined economic and organization problem. Before any processing is done by them on an extensive scale they will investigate most carefully the possible market for the by-products considered—the extent of demand, the market prices and the stability of both. Such a study will have to take into account the effect of extensive processing on the by-products market and on the price of raw fuel. With the market determined, will the revenue from by-products carry a large enough percentage of the fixed and operating charges, including commercial expense of disposal, to enable the power-plant fuel to be obtained at sufficiently reduced expense? Or, viewed from another angle, will the by-products leave a satisfactory net profit to justify processing fuel after fixed and operating charges are deducted? These charges have yet to be determined for the various processes which are now technically obtainable.

Even if the market for by-products is found attractive because of magnitude, unit prices and stability, and even if the revenue will more than offset all fixed and operating charges of processing, an electric utility will have to consider the organization problem. Processing requires installations and operating methods quite unfamiliar to electrical engineering and operating men; therefore additions to staff may have to be made in both engineering and operating organizations. Selling of by-products is not like selling electrical energy or merchandise. Is the increased complexity of organization warranted by the net profit obtained?

The organization or commercial problem is not so difficult in a utility company that provides both electricity and gas, because the engineering, operating and commercial problems of gas manufacture already involve many of the processing problems. Neither would the commercial problem be so difficult for a straight electric utility if all the by-products could be sold wholesale to a gas company in the same town and if the processing plants were located near enough to the gas plants. However, to sell the by-products to a number of purchasers would entail considerable difficulty.

If processing of all coal used by utilities becomes economical from a production and revenue viewpoint, it might be conceived desirable some day to have all processing in one locality done by one organization which would dispose of gas to the gas-distributing company

and power-plant fuel, or possibly electrical energy, to the electric service company, and so on. Whether such an arrangement would be feasible is another subject which requires careful consideration inasmuch as utility companies sell a service and not a commodity.

Electric Baking Growing in Favor

MANY utility companies will find it profitable to study the possibilities of baking bread, pies, cakes and other bakery products in electric ovens. Experience has demonstrated the popularity of electric ovens with bakers who have used them. Each load of bread, each pie and each cake is exactly like its fellow, and every bake is similar in character. There is a minimum of rejected products and a maximum of uniformity in product. Tests show that power costs are negligible, ranging from 42 cents to $1.10 per 1,000 lb. baked.

Quite a large baking load is available. A recent survey in a certain city shows an annual consumption of 100,000,000 kw.-hr. by the bakeries in operation, and the utility commercial department believes a selling campaign will obtain all this business very readily. The load is excellent since the baking ovens operate about sixteen hours a day with a constant load and servicing troubles are at the minimum. It is obvious that a commercial opportunity exists for every light and power company to add the baking load as profitable new business.

The baking industry has provided a large market for electric trucks. Ovens can be sold also, on the record of existing installations.

Use and Abuse of Colored Light

WITH the great increase in the efficiency of light production which the tungsten filament gave, it was very natural that colored lighting became important; but this new possibility also emphasized the need of artistic ability on the part of lighting specialists and of reasonable restraint in the demands for various colors and tints of lamps and of accessories. One of the most discouraging factors has been the variety of individual demand. Obviously, it is costly to supply a large diversity of hues, and it is particularly discouraging since only a few tints and colors can be satisfactorily used for most colored-lighting purposes. When looking at the possibilities purely from an artistic viewpoint it may seem that tints in infinite variety are necessary. However, when the possibilities of mixing colored light, the effect of tinted shades and the influence of wall coverings and furnishings are considered along with practical needs, one finds that much can be done with a few colors and tints.

There are only four conspicuously different colors—red, yellow, green and blue. These have been gradually reaching a more or less standardized state in colored-glass accessories. By mixing these lights judiciously with each other and by diluting them with colorless light a wide variety of tints can be obtained, and with much satisfaction if such possibilities are borne in mind when the lighting system is being designed. Lamp manufacturers have aimed to supply lamps in these four colors and also in a tint of each. They have also made the flame-tint lamp available to provide the warm semblance of the old flame illuminants. In homes, hotels and other artistic interiors virtually any desirable light which may be "lived with" satisfactorily can be obtained by combining silk or glass shades with clear, flame-tint or daylight lamps. In ballrooms, theaters, public halls and other places where more spectacular effects are desired the four colors mentioned satisfy most reasonable demands.

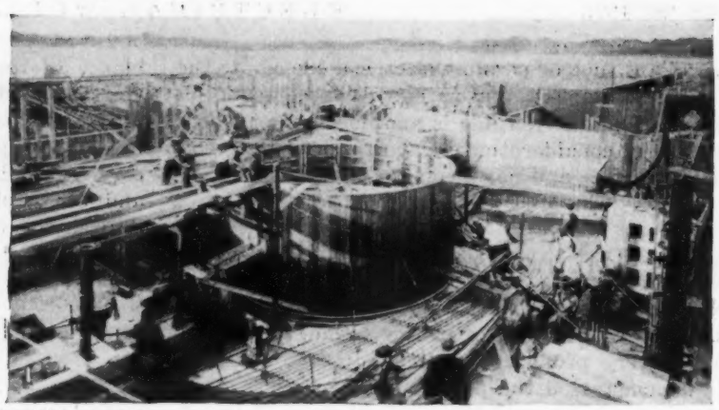
Better Lighting Speeds Plant Construction

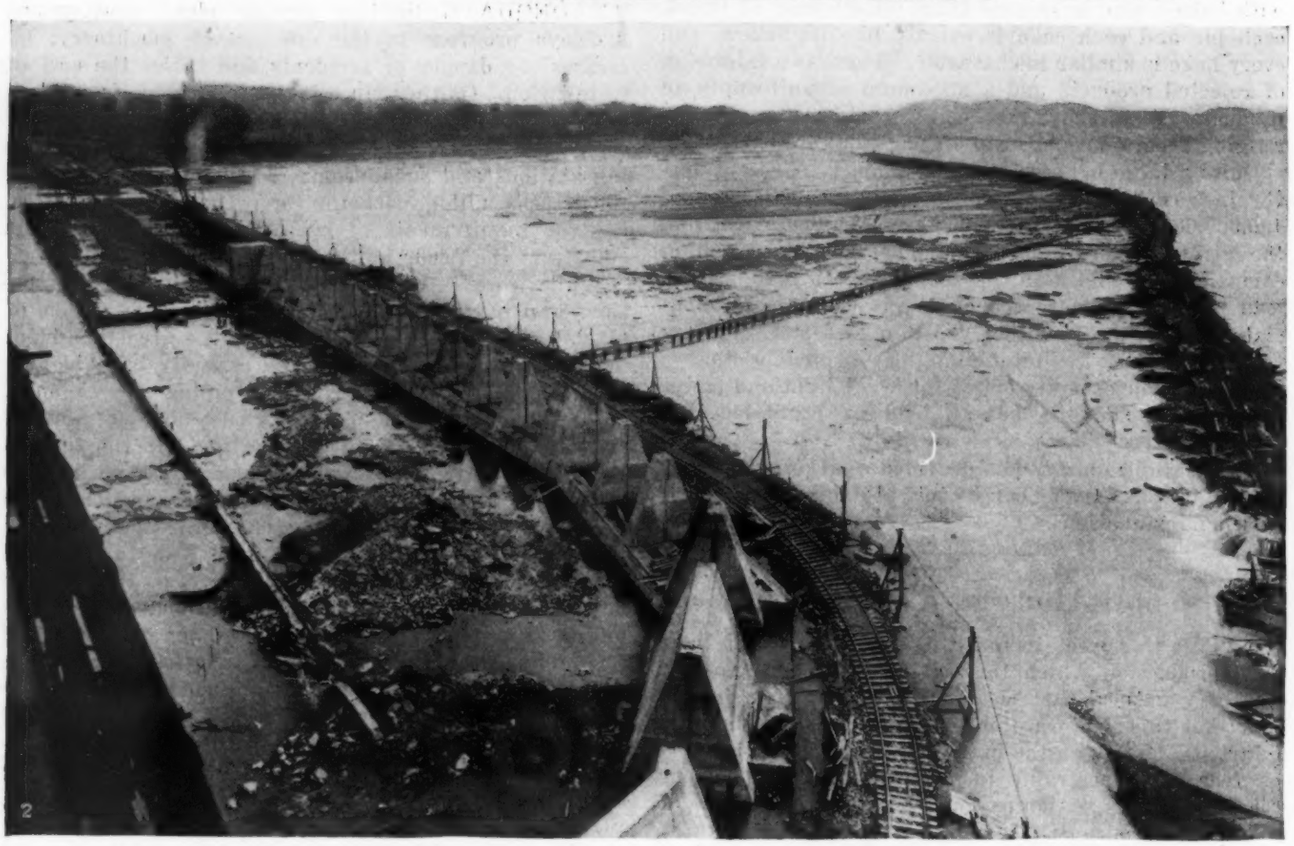
INADEQUATE lighting during plant construction delays progress in the erection of machinery, increases the danger of accidents and raises the cost of installation. On the principle that the cobbler's children are often the most poorly shod, many light and power companies neglect proper lighting in building generating stations and substations. Provision may be made for first-class illumination in the permanent installation, but the requirements of operation differ widely as a rule from the needs of the construction period.

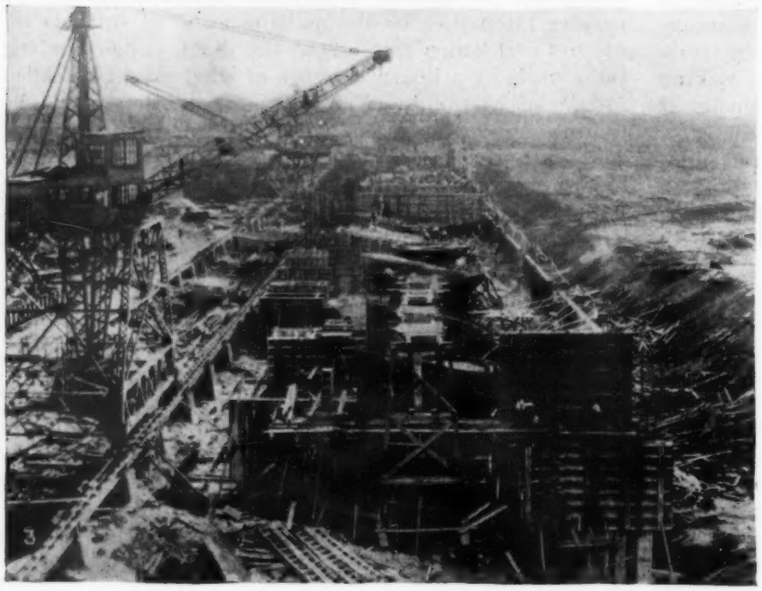
While work is under way many temporary obstructions impair the usefulness of the permanent system of plant lighting. In the boiler house the great height of modern furnaces and the large capacity of tube sections, together with the extensive piping now common, not seldom demand the use of a vast amount of staging and wooden falsework during erection. In the turbine room units arrive in sections with parts packed in cases of giant size, and under the best of conditions it is necessary to pick one's way carefully through such places prior to final cleaning up. The tendency is marked for construction forces to use 100-watt to 200-watt bare lamps mechanically protected by screen guards and fed through cable designed to withstand severe usage in carrying on installation work. Too often little or no attention is paid to cutting down glare by employing portable floodlamps and reflectors around machinery in process of installation, and very frequently the general intensity of illumination is far below what is desirable.

Fortunately the remedy is fairly easy to apply. It should not be difficult to provide temporarily for far greater intensities by the multiplication of suitable reflectors and lamps throughout the plant, supplementing these units by a liberal number of what might be called industrial portables. The cost of operation would be trifling in relation to the losses, direct and indirect, now sustained through poor illumination. Suppose 100 500-watt lamps were thus required in a new station with an initial equipment rated at, say, 100,000 kw. The cost of supplying this load would be only 50 cents per hour at 1 cent per kilowatt-hour, and what does this amount to in comparison with the cost of labor in a modern construction job and the value of each day saved in getting units of a high-powered station upon the line? It is hard to imagine a greater source of careless waste on a construction job from the standpoint of time lost than is poor lighting, and it is hardly an exaggeration to say that it is practically impossible to light an interior construction job extravagantly until one reaches intensities of illumination far beyond the range of the engineer's present day practice in this field.

Development of the Hydro-Electric Project at Ohio River Falls







DEVELOPMENT of electric power at the only falls in the Ohio River is being made possible by the construction of a dam at Louisville by the federal government as a part of a plan to establish a 9-ft. channel for navigation from Pittsburgh to the Mississippi. The hydro-electric plant is being constructed by the Byllesby Engineering & Management Corporation for the Louisville Gas & Electric Company at an estimated cost of $7,500,000. The Byllesby organization is also building the dam for the federal government. The initial capacity of the plant will be about 80,000 kw. in eight 10,000-kw. units. The operating head will be 37 ft. maximum. On account of the fact that this is simply a stream-flow project, it is now planned to erect a companion steam plant of 180,000 kw. adjacent to the hydro-electric power house after the completion of the latter. It is expected that the hydro project will be in operation early in 1929.

No. 1. Erecting concrete forms for unit No. 1.

No. 2. Government dam under construction across the Ohio River.

No. 3. Hydro-electric station made possible by government dam.

Chicago Sets a New Standard in Street Lighting

High-Intensity Illumination on State Street Necessitates Development of New Type of Lamp—Simple Control Method Reduces Costs

By S. W. THOMPSON
Illuminating Engineering Association, Commonwealth Edison Company

THE most active retail section of State Street, Chicago, extending between Van Buren and Lake Streets—a distance of 3,150 ft.—will have a lighting intensity of 2,000 lumens per linear foot of street. This installation for the State Street Lighting Association, an organization of business men, will involve 140 2,000-watt lamps with a rated output of 45,000 lumens per lamp, which means that this business district will be flooded with 6,300,000 lumens. Compared with several other large-city installations, the State Street development will have two and one-half to four times their lighting intensity.

To develop a lamp that would meet the requirements of this installation a great deal of research was conducted by the Commonwealth Edison Company in co-operation with the General Electric Company. The bulb known as type C-52A1, which from now on will be a standard lamp for base-down burning, was the outcome of this work. The lamp, owing to its large radiating surface, lowers the possibility of glass distortion from excessive heat. In addition there is a pocket at the peak of the lamp where material thrown off by the filament concentrates, so that the minimum cut-off of the upper rays of light results. The lamp's over-all length is 16½ in. and its maximum diameter is 6½ in. The glassware selected for this installation is known as the Novalux rippled glass, form 126 globe and 1,126 canopy. So far as known this is the largest glassware that has ever been made for street-lighting purposes.

2,000-WATT BASE-DOWN LAMP DEVELOPED FOR THE STATE STREET LIGHTING

The standard selected is a combination trolley pole and lighting standard. As a result of this combination about 45 poles now installed on the street will be eliminated. The inclosing and incasing ornamental standard was designed by Graham, Anderson, Probst & White, architects, and approved by the Commissioner of Gas and Electricity of Chicago. This standard was manufactured by the Union Metal Manufacturing Company of Canton, Ohio, and installed by the Commercial Light Company of Chicago for the Commonwealth Edison Company.

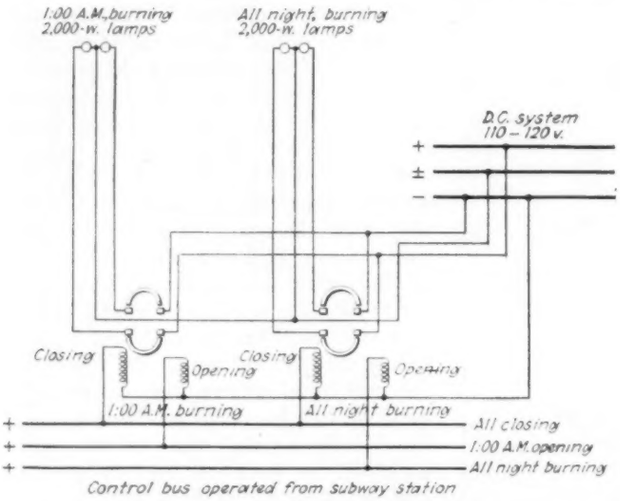
To protect against corrosion the Chicago Surface Lines insisted upon provision for periodical inspections of the trolley poles, so the ornamental shaft of No. 11 gage steel was made in two longitudinal halves, flanged and fastened together by machine screws. When the parts are assembled, they look like a one-piece shaft. This construction will eliminate the necessity of detaching the trolley span wire from the top of the standard whenever it is necessary to make an inspection of the trolley pole. By removing the machine screws the ornamental sections can be removed from around the trolley pole, the trolley pole painted, the base castings raised for inspection and the base of the pole painted.

As this street-lighting system is situated in the direct-current district of the Commonwealth Edison Company, it was decided, in order to lower the installation cost, to connect these lamps onto the service stubs now accessible along the curb walls on both sides of the street at different points. Control for this installation is centered in the East Madison Street substation, which is about centrally located. The remote-control bus consists of three wires of positive polarity installed in ducts extending along both sides of the section to be lighted. Taps from this bus are connected to remote-control, solenoid-operated circuit breakers controlling the lamps and are equipped with closing and opening coils. One of the positive bus wires is for closing purposes only. One of the two others is for controlling 49 of the standards (or 98 of the lamps), which are switched off at 1 a.m. The other control wire is used for switching off 21 standards (or 42 lamps) at daylight. The system negative is used for the return control circuit, thus permitting a material saving in labor and material.

For future capacity, required either by increased wattages or installation of decorative festoon lighting, 2,000 watts additional capacity has been provided in each of the lighting standards and will be available through a fuse block tapped to the wiring in the top of the standard.

The desirability of maintaining these standards in a vertical position made it necessary to use 31-ft. trolley poles, 6 ft. of which extends below the sidewalk level. The trolley pole has an inside diameter of 9 in. at the bottom and is made of extra-heavy steel. The span wire is attached 24 ft. above the sidewalk level, that part of the pole rising above the attachment being used to support the upper castings of the ornamental standard. The cables feeding the street lights and trolley system are brought up through the trolley pole from the base, which in most cases is imbedded in concrete, and connections with the lamps and overhead trolley system are made at the extreme top of the pole.

No conduit or insulation outside of the cable insulation is used in the trolley pole for cable protection. Two



CONTROL SYSTEM FOR STATE STREET LIGHTING

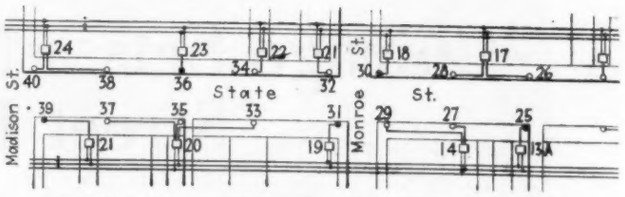
ells in the concrete base permit installing the wires or cables after the trolley poles are set. As most of the curb walls on the street are retaining walls and the space between the building and the curb lines is excavated for basements, most of the control equipment was installed in this space adjacent to the pole foundations.

The trolley poles are installed with a 4-in. rake, but when the trolley span-wire is pulled up taut, the poles will assume a vertical position. At that time the base of the ornamental casing will be grouted and the shaft trued in place.

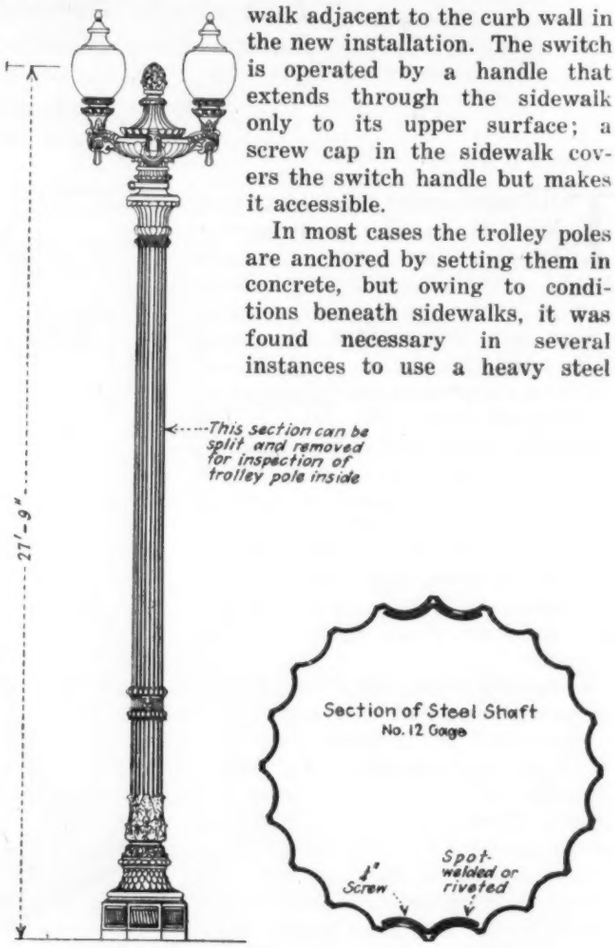
Past standards of the Chicago Surface Lines required the installation on the trolley pole of an inclosed air-brake knife switch for control of the trolley feeders. Since such an attachment was considered unsightly and was objected to by the merchants, a special inclosed air-break switch is mounted on the underside of the side-

COMPARATIVE LIGHTING INTENSITIES OF SOME LARGE CITIES

	Lumens per Linear Foot
State Street, Chicago	2,000
Salt Lake City, business section	822
Niagara Falls, Falls Street	761
San Francisco, Market Street	750
Schenectady, Erie Boulevard	700
Portland, Ore., business section	600
Schenectady, State Street	585
Indianapolis, business section	520
Los Angeles, Broadway	510
San Francisco, Triangle district	500
El Paso, business section	500
Cleveland, Superior Avenue	500



PARTIAL PLAN OF LIGHTED AREA SHOWING SPACINGS


This section can be split and removed for inspection of trolley pole inside
27'-9"
Section of Steel Shaft
No. 12 Gage
4" Screw
Spot-welded or riveted

FEATURES OF STANDARD AND SPLIT SHAFT

walk adjacent to the curb wall in the new installation. The switch is operated by a handle that extends through the sidewalk only to its upper surface; a screw cap in the sidewalk covers the switch handle but makes it accessible.

In most cases the trolley poles are anchored by setting them in concrete, but owing to conditions beneath sidewalks, it was found necessary in several instances to use a heavy steel casting known as a pole-pot. This was anchored, by means of "U" bolts, to the I-beams that support the sidewalk and are attached to the various steel structures.

The promotion of this installation was inaugurated by some of the leading State Street merchants, who formed the State Street Lighting Association, in co-operation with the Commonwealth Edison Company. An agreement was drawn between the association and the property owners or tenants, pledging the co-operation of the person or corporation signing it and requiring the payment of $12.54 per front foot per year for the first five years and $7.76 per front foot per year for the second five years. The amounts subscribed on this basis are somewhat in excess of the amount required by actual costs but provide a reserve to take care of contingencies. After sufficient frontage was secured on this basis, the association entered into a contract with the Commonwealth Edison Company for the installation, maintenance, current and lamp renewals for a ten-year period.

What Interconnection Means to the South

Continuous Lines from Missouri and Kentucky to Florida and from Louisiana to Virginia Will Soon Be an Actuality—Bearing of Muscle Shoals on Future Development in This Great Region

By WINGROVE BATHON

ON NOV. 19 the closing of a switch in the Clarion River station tied together interconnected transmission systems stretching from Milwaukee to Boston. Feats such as that, however, involving no transfer of energy from end to end, will be nothing compared with the present and proposed interconnection from Missouri and Kentucky down to Florida, and from Louisiana up to Virginia, taking in the states mentioned as well as Arkansas, Mississippi, Tennessee, Alabama, Georgia, South Carolina and North Carolina. This present and proposed interconnection is shown on the accompanying map.

MUSCLE SHOALS IN THE CENTER OF INTERCONNECTED SYSTEMS

In the midst of this interconnected network lies Muscle Shoals, about which centers a problem important to the electrical industry—namely, shall Muscle Shoals be government-operated or shall it be leased to a group of thirteen power companies in the South which have organized the Muscle Shoals Power Distributing Company and the Muscle Shoals Fertilizer Company?

But while these considerations occupy the attention of legislators in Washington, something else is happening in the whole southeastern part of the United States. Physical interconnection is moving forward with great strides. It happens that the Federal Power Commission is now studying the territory shown on the map to ascertain how rapidly development must take place on the Tennessee River to supply the sharply increasing demands for power in contributory territory. According to O. C. Merrill, executive secretary of the Federal Power Commission:

"For six states shown on the map—namely, North and South Carolina, Georgia, Alabama, Tenessee and Kentucky—statistics show that from 1920 to 1925 the aggregate kilowatt-hour output of the central stations has increased from 3,000,000,000 to 5,000,000,000, or 67 per cent in five years.

RAPID GROWTH OF UTILITIES IN THE SOUTH

"This is a marvelous increase in the output of electrical energy, due both to the increase of industries and to the more widespread use of electrical energy, made possible by just such interconnections and proposed interconnections as the map shows. The greatest and the most rapid development in all the states on the map has taken place in Alabama. In the five-year period Alabama has progressed from just under 500,000,000 kw.-hr. to 1,200,000,000 kw.-hr. South Carolina stands second in the ratio of development, or, rather, it might be said, South Carolina and North Carolina have been going along nearly together. In North Carolina, from less than 300,000,000 kw.-hr. the figures have grown to almost 1,000,000,000 kw.-hr. in five years. Tennessee development has been irregular, although since 1921 the output is increasing rapidly. Georgia has been going up and down, and down and up.

"The interconnection of the Arkansas plants with those of Alabama and western Tennessee will afford a means of supplying energy in Mississippi that would not otherwise be possible except by isolated steam stations, so that all proposed interconnections in this territory are especially significant to the State of Mississippi. There is an active interconnection interest in Arkansas at the present time. There have been recent constructions, one already built on the Ouachita, and there are projects under consideration on the White River that materially increase capacity, to make possible the supplying of energy into southern Missouri and northern Mississippi, which have little or no hydroelectric potentialities of their own. The interconnection in west Tennessee and northern Alabama that has been projected will necessarily lead to the increase in development of the Arkansas water powers."

NEARLY EVERY STATE INTERCONNECTED IN DISTRICT MAPPED

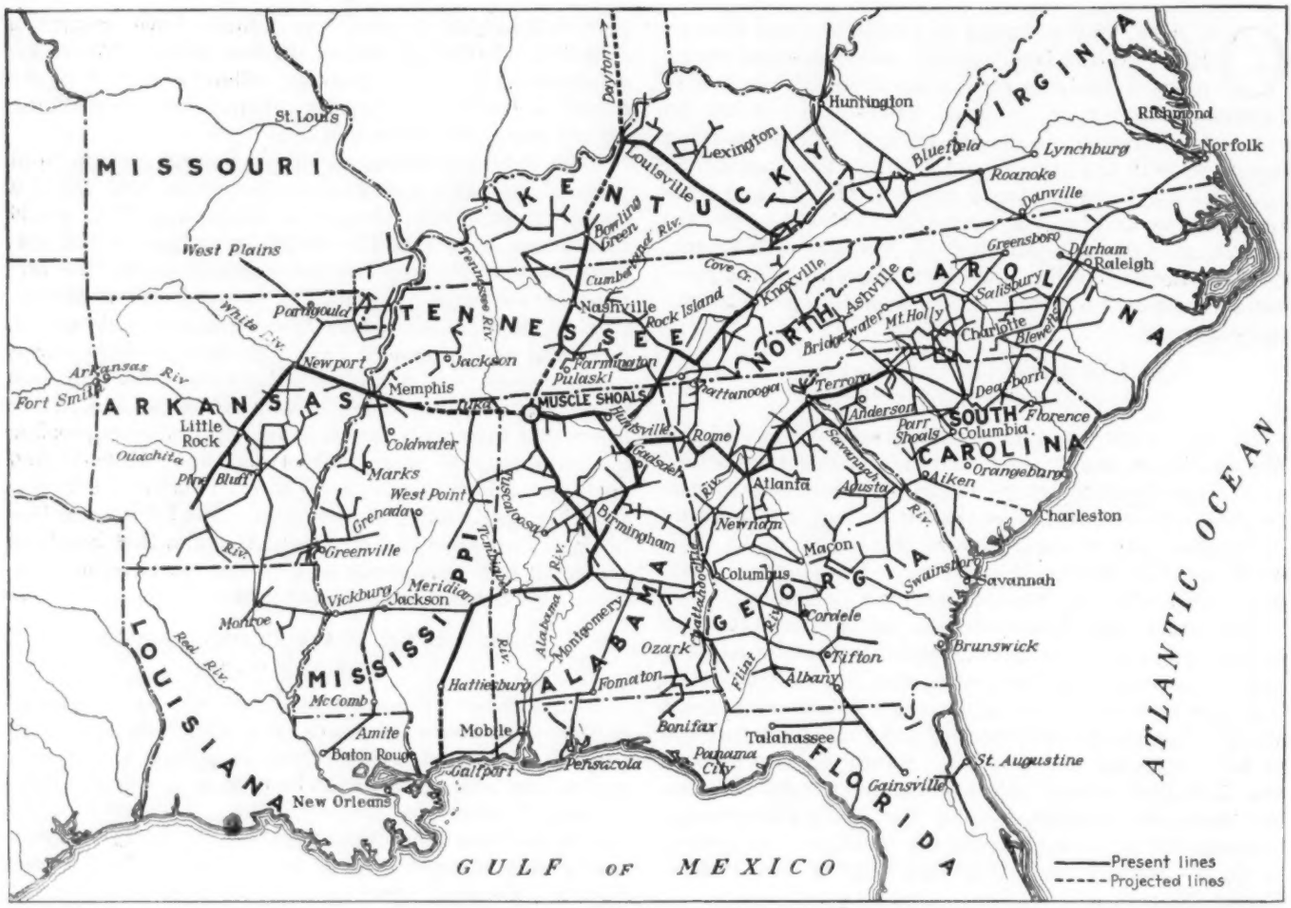
In his book "Superpower as an Aid to Progress," published a couple of years ago, Gen. Guy E. Tripp alluded to what he called "the Southern superpower system" in terms that might be used as a classical illustration of economic interconnection. He spoke of the system as being "over 600 miles long." Today this system is expanding so rapidly that it is hard to keep up with it. General Tripp spoke only of the interconnection in Alabama, Georgia, Tennessee, South Carolina and North Carolina, and only of the Alabama Power Company, the Columbus Power Company, the Georgia Railway & Power Company, the Southern Power Company, the Carolina Power & Light Company and the Georgia-Carolina Power Company. Since his book was published Missouri, Kentucky and Virginia have come into the Southern system on the north; Arkansas, Mississippi and Louisiana have come in on the west, and Florida has come in on the south.

The map shows that there are but few dotted lines, representing projections still to be built. One of these is from Bowling Green to Louisville, in Kentucky; another, a short stretch above Nashville, and another, a longer and more important stretch, down to Muscle Shoals in northern Alabama; another is from Iuka, Miss., near Muscle Shoals, northwest to Memphis; another is from Baton Rouge, La., to New Orleans and from New Orleans to Gulfport, thence to Mobile; another is the extension of the line beginning at Aiken, S. C., on to Charleston. Virginia and North Carolina are

already interconnected with a line from Norfolk to Durham, but there is another short interconnection projected from Durham to Danville.

Speaking in the South recently, George Gordon Crawford, president of the Tennessee Coal, Iron & Railroad Company, a subsidiary of the United States Steel Corporation, advocated decentralized manufacture and the bringing of power to labor. He instanced a long list of articles that might be manufactured in the smaller communities, avoiding long hauls on raw material and long return hauls on manufactured products, thus saving enormous transportation charges, bringing to local communities many of the byproducts of manufacture, such as banking fees and commissions, insurance premiums, etc. He strongly urged that the South, from the standpoints of raw materials, proximity to markets, power, labor supply, climate and taxes, offered a fertile field for decentralized manufacture. This movement is proceeding, and one of the best evidences of it is the continued accretions to the Southern cotton-mill industry.

A most enlightening grasp of this vision is obtainable in the studies made by some of the power companies in the South as to the industries and the resources of the territories they serve, as well as the studies they have made for prospective power requirements. Take, for instance, the estimates of the Southeastern Power & Light Company. That company's analysis of future power needs in the five Southern states Alabama, Florida, Georgia, Mississippi and South Carolina is shown in the accompanying table.



MUSCLE SHOALS LIES IN THE MIDST OF AN ENORMOUS TRANSMISSION SYSTEM WHICH EXTENDS OVER THE ENTIRE SOUTH, INCLUDING ARKANSAS ON THE WEST AND KENTUCKY AND VIRGINIA ON THE NORTH

ANALYSIS OF POWER NEEDS OF FIVE SOUTHERN STATES
(Alabama, Florida, Georgia, Mississippi and South Carolina)

Year	Kilowatts Demand	Kilowatt-Hours Consumption
1926	400,000	1,950,000,000
1927	480,000	2,300,000,000
1928	540,000	2,600,000,000
1929	620,000	3,000,000,000
1930	700,000	3,400,000,000
1935	1,000,000	5,000,000,000
1940	1,400,000	7,000,000,000

The industrial development of the South is surpassing all previous records. In 1923 the manufactured products of Alabama, Florida, Georgia, Mississippi and South Carolina were valued at $1,306,180,000. The value of all the manufactured products of the whole South in 1923 was $9,450,000,000, which was double the value of the South's farm crops that year. Since then production has been expanding at a rapid rate, and it is very generally held that this industrial growth and development will be greatly enhanced if Congress removes the bugbear of possible government operation of Muscle Shoals, with its attendant competition with private industry, thus taking that power out of its present "twilight zone" and fixing its future status, so that all other developments may go forward suitably co-ordinated.

Regulator for Flywheel Balancer Sets

Handling of Certain Loads Introduces Peaks Which Can Be Smoothed Out by Using Flywheel Sets—Regulator and Protective Devices Developed to Control Operations

By J. H. ASHBAUGH
Regulator Engineering Department, Westinghouse Electric & Manufacturing Company

APPLICATIONS of electricity to industry involving heavy and intermittent peak loads such as are occasioned by ore or fuel unloading by grab buckets or other devices introduce a problem of developing flywheel balancer sets with adequate controls to limit the energy stored or demanded in order to serve the loads from existing lines or generating equipment. The characteristics of some loads, such as at ore and coal docks, are very high current values for very short durations of time. If the generating equipment or line characteristics are such as to make such loads prohibitive, flywheel balancer sets are used.

A flywheel balancer set consists of a heavy flywheel driven by a motor connected to the bus having the heavy peak load. The action of the balancer is to store energy in a flywheel when the load is light and return this energy to the bus when the peak load occurs. If the load is removed, the bus voltage rises and the motor speeds up, storing energy in the flywheel.

A flywheel driven by a motor therefore tends to reduce the load fluctuation on the generator. Without any auxiliary device the power given up by the flywheel is almost negligible unless the bus voltage drops considerably from no load to full load. It is advisable to hold a constant bus voltage, so the generators are as a rule flat-compounded. Since it is not good practice to vary the bus voltage, the counter voltage to the motor is varied by changing the field excitation in accordance with the load changes.

CONSTANT-CURRENT REGULATORS

The excitation to the motor is usually changed by a vibrating regulator such as is shown in Fig. 1. The control element *C* is wound for current and operates either from a shunt or from the interpoles of the machine, as shown in the diagram. When a load comes on the machine the current in the shunt *S* causes an increase in the current in the coil *C* so that it pulls down its core, and consequently the lever *L*, which closes the main contacts *M*. These contacts in turn energize one winding of the differential relays; the other winding is permanently energized and the two are connected to oppose each other. The spring *S* then pulls the armature up, closing the contacts *K*, which short-circuits the motor field rheostat. The excitation to the motor is increased when the current in the shunt *S* exceeds the value for which the control coil and its spring are set. The increased excitation increases the counter voltage so that power is delivered to the bus by the flywheel.

The regulator is vibratory in its action—i.e., it will vibrate holding a constant current in the shunt. If the flywheel is properly designed to meet the load conditions, the entire energy will never be required except under very extreme conditions. The regulator will function in the same manner when the load goes off the bus, but in this case the power is put into the flywheel by the tendency of the vibrating action to reduce its counter voltage rapidly, thereby speeding it up. Thus the load on the generator is kept at a fair uniformity, as the flywheel takes off all of the peaks and tends to fill up the valleys.

Regulators of the above type have been in operation for several years and have clearly demonstrated their

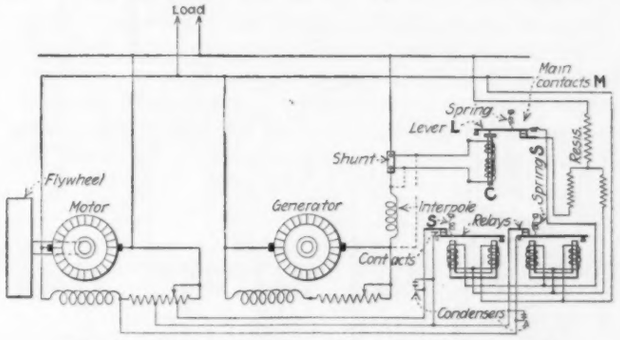


FIG. 1—VIBRATING REGULATOR FOR SMALLER SETS

value. There is, however, a limit to the amount of field current that can be handled by them. Quite recently another type of regulator has been developed which has unlimited possibilities as regards size of machine. This type of regulator permits the use of a separately excited motor and varies the voltage of the exciter in order to vary the excitation of the motor. Protection equipment is used with it so that the constant-current regulator cannot cause the machine to give up or store energy faster than a given rate. In other words, it limits the armature current of the flywheel balancer set.

This regulator (shown in Fig. 2), is similar in design to the already well-known voltage regulator. The left-hand magnet has a current winding which obtains energy from a shunt, as indicated in the diagram. The vibrating magnet (right-hand magnet) has two windings, one the current winding, which predominates, and the other the voltage winding. The voltage winding has its strength varied by a vibrating relay which short-circuits a section of the external resistance in series with it. The effect of this winding is to cause the regulator to vibrate, the rate depending on the current from the shunt. Thus it is seen that if the current increases, the main control coil pulls the plunger up and thereby moves the floating lever up. This opens the main contacts—which open one winding of the differential relays and the contacts *V*—but closes the contacts at 1. The closing of the contacts at 1 short-circuits the exciter rheostat and its voltage rises in value, which increases the excitation to the motor so that it becomes

a generator feeding energy to the bus. The load on the main generator is then held at a constant value. The pull of the vibrating magnet is then decreased by relay *V* opening the short-circuited resistance *r*, and its plunger lowers, closing the main contacts *M* and thereby contacts *V*-2. This closes the short circuit on *r*, and immediately the pull of the vibrating magnet is increased and the contacts again open. The above sequence is repeated so that the regulator vibrates as before but at a new rate. This new rate of vibration is such that the excitation keeps the load on the main generators at the predetermined value. This action increases as the speed reduces or as the load increases, so that the peak load is taken by the flywheel set. When the load decreases the action is reversed and the balancer takes power from the bus.

The action of the vibrating magnet is quite interesting. This magnet is the stabilizing element and has its pull aided by the main control spring. Changing the tension of the spring will change the time of contact engagement, as will also changing the position of the

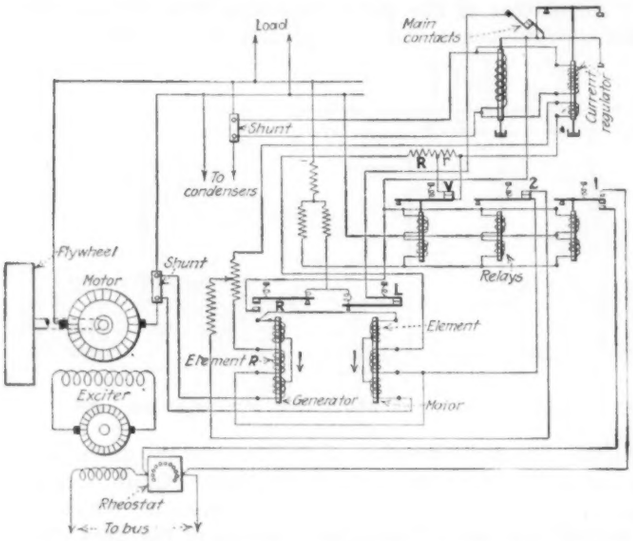


FIG. 2—DIAGRAM SHOWING ARRANGEMENT FOR PREVENTING CURRENT SWINGS AND A NEW TYPE OF REGULATOR FOR LARGE BALANCER SETS

main contacts. This is the case because, in order to reach a balance, the average upward pull plus the spring tension must balance the core weight. If the spring tension is varied, the pull must vary in order to keep this balanced. Should the main contacts vary in position, the core will also change its position, which in turn will vary the spring tension and the time of engagement. The time of contact engagement varies in accordance with the load on the generator so as to keep this at a constant value. The magnet has its core attached to the floating lever and changes the position of this lever with the load. The main contact is carried by the floating lever, and thus, as the main control core changes its position with the current in the shunt, the floating lever varies the position of the main contact and thereby effects the excitation of the balancer set.

Should the demands for power be sufficiently large, the regulator might easily give too much excitation in an endeavor to keep the load on the generators at the predetermined value. This might overload the balancer either for input or output; i.e., tend to accelerate it too fast if the load was suddenly reduced. To prevent this a scheme of protection was devised which permits the current regulator to function normally up to full load on the balancer set, after which the control is transferred to another element. This element prevents the balancer armature current from ever exceeding this value.

For the protection of the set two control coils are used, one for generator power and one for motor power. These operate through the medium of the same rheostat-shunting relays. The control of these relays is merely shifted from the main control element (current) to one of the protective elements, depending on the direction of the power. It is necessary to reverse the action of the protective device when the balancer is taking power as compared with its action when it is generating power. In order to distinguish between these two conditions the protective element utilizes a control coil which is responsive to power; i.e., it is a real watt coil. This is a three-winding coil and exerts a pull directly proportional to the watts in the circuits.

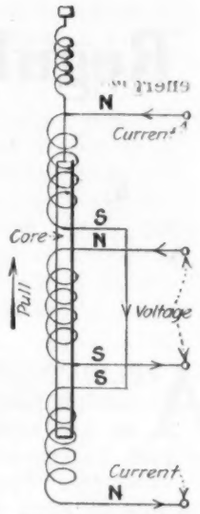


FIG. 3—THE WATT COIL HAS THE TWO END COILS CONNECTED FOR OPPOSITE POLARITY

The watt coil is shown in Fig. 3. The two end windings are connected for opposite polarity while the middle coil can be connected so as to assist either end coil. When connected as shown in the figure, it will pull up, but if the current is reversed, the voltage winding remaining the same, the pull will be reversed. This action is used to distinguish between motor and generator current. Fig. 2 shows the schematic diagram of the protective equipment in connection with the regulator. Should the balancer be feeding power to the load and the regulator cause this outgoing current to exceed a predetermined amount, then the pull of element *R* will overcome the spring tension and close its contacts. This will energize the other section of the differential relays 1-2-*V* so that their springs will pull the armatures up, opening contacts 1 and reducing the excitation so that the current will reduce. When this current has reduced sufficiently, the contacts of element *R* will open, thus opening relay contacts 1 and increasing the excitation. The above sequence will again take place. It is to be noted that the current and voltage coils of the *R* and *L* elements are in series and that the generating current flowing through the *L* element causes it to pull up, assisting the spring and holding the contacts closed.

When the conditions are reversed, namely, for motor

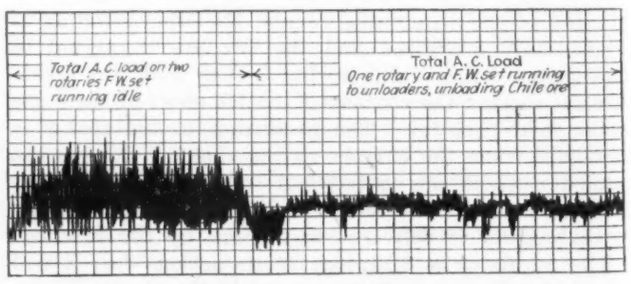

Total A.C. load on two rotaries F.W.set running idle
Total A. C. Load
One rotary and F.W.set running to unloaders, unloading Chile ore

FIG. 4—GRAPHIC METER CHARTS TAKEN WHILE IDLE AND WHILE UNLOADING ORE AT THE RATE OF 750 TONS PER HOUR

action, and the current exceeds the safe value, the element *L* pulls down while element *R* pulls up, keeping the contacts *R* open. The opening of contacts *L* de-energizes the relays 1-2-*V*, which were energized by the main contacts *M*, thus closing contacts 1 and immediately strengthening the field and reducing the current input. This reduction in current allows the spring *L* to close the contacts *L*, thereby decreasing the excitation, and this action is again repeated.

The swings in current would be large under the direction of the protective device if some preventive force did not come into play. Relay 2 is operated by either contact *R* or *L*. The contacts 2 place a shunt in parallel with the voltage coil of element *R* and this combination in series with the voltage coil of element *L*, as shown in Fig. 2. When the contacts at 2 close, the pull of element *R* is decreased while the pull of element *L* is increased. The net result in either case is to set up a force which counteracts the force causing either element to work so that the contacts move to their original position, thus anticipating the change in armature current. However, as soon as the contacts either open or close, depending on which element is in control, the contacts 2 open so that only the original pull is in effect and the contacts again operate. The number 2 relay then causes the elements to vibrate, thus maintaining a constant input or output. The main current regulator does not come into play inasmuch as the instant the protective element starts to operate the excitation is changed so that the main contacts either stay open or closed, owing to the change in excitation.

The substation in which this balancer is used consists of two 500-kw. rotaries delivering 250-volt direct current to two unloaders and the necessary pusher locomotives. The incoming line is 13,200 volts, three-phase, 60 cycles. In order to reduce the peak load on the rotaries and consequently on the distributing system, the flywheel balancer is used.

The balancer set is automatic, starting by means of current acceleration. The motor driving the flywheel has its own exciter direct-connected, so that, in starting, the motor is separately excited from the bus. When the exciter has built up to the proper voltage, the excitation is automatically transferred to it. Dynamic braking is employed when shutting down in order to reduce the time to bring the set to rest.

The graphic meter chart shown in Fig. 4 indicates the action of the regulator when the load was varying rapidly. This was made with a high-speed meter, and in the first part of the chart the flywheel was only floating on the bus, the regulator being off. The latter part shows the effect of cutting the regulator into service.

From the foregoing it is seen that the regulator will limit the peak load on the rest of the generating equipment, and with a regulator of this type the size of the flywheel motor can be unlimited, owing to the fact that the current of the motor is not handled directly on the contacts of the relays. Every precaution was taken to make the equipment reliable and bring any overloads on the motor under the control of the regulator.

Method in Sales Plan Spells Success

Experience of New Castle Central Station Shows Importance of Attention to Detail and Technique in Conducting Any Sales Campaign—Conclusions Drawn

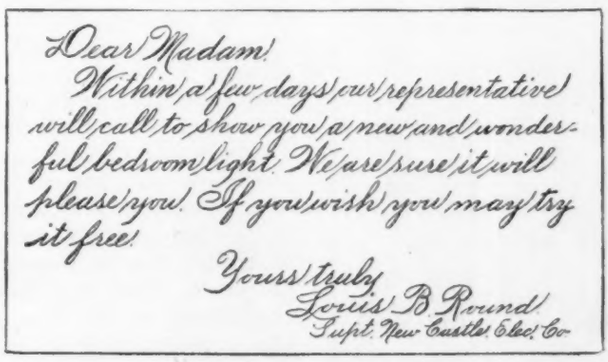
By FRANK B. RAE, Jr.

THE New Castle (Pa.) Electric Company, a division of the Penn-Ohio System, some time ago conducted a bedroom-lighting campaign under direction of L. B. Round, superintendent, that may well be described as a masterpiece of methodical planning.

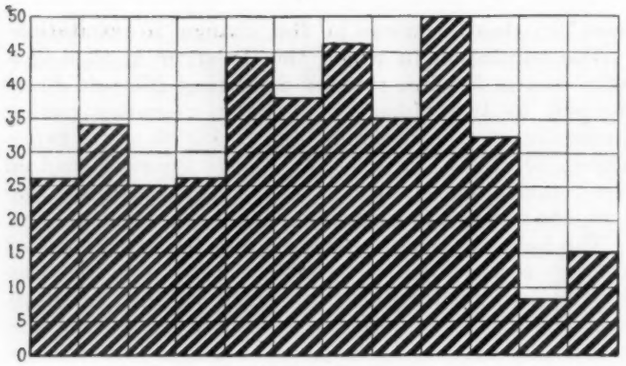
The campaign was carried on in the city of New Castle and affected approximately 11,000 residence customers, of whom more than 8,500 were actually interviewed. Initial sales were made to more than 15 per cent of those interviewed, the net sales, deducting cancellations and removals, were better than 12 per cent and less than 4 per cent of the units installed were removed after trial. When the conditions of the territory and nature of the lighting unit offered are considered, this result is notable.

The unit consisted of an ornamental ceiling hanger, a 10-in. Nuite inclosing globe with special decoration, and a 100-watt lamp. The selling price was $6.95 each, payable 45 cents with the first bill and 50 cents monthly thereafter, or a discount of 50 cents was allowed for cash in ten days from the date of installation. A separate order was required for each unit sold, the terms of payment applying individually on each order. Five days' free trial was allowed.

As previously stated, this campaign was a masterpiece of methodical planning. In advance of any solicitation, the complete system of prospect cards, combination order and inspector's permit blanks, advertising postcards, call-back cards, sales ledger sheets, accounting department information sheet, contractor's installation order form, contractor's removal order form, salesman's commission record sheet, contractor's pay record sheet and a rubber stamp form for keeping track of the progressive


Dear Madam:
Within a few days our representative will call to show you a new and wonderful bedroom light. We are sure it will please you. If you wish you may try it free.
Yours truly
Louis B Round
Supt. New Castle Elec. Co.

IMITATION PEN-WRITTEN POSTCARD SENT IN ADVANCE OF SALESMEN



AVERAGE WEEKLY SALES PER MAN

steps of each order were prepared, together with a written outline of each step in the operation of the system. It may appear to the reader that this is rather an awesome list of forms and records. The point is that it was largely because he so carefully prepared these records, forms and the detailed instructions governing them that Mr. Round's campaign was successful. In his own words, "Attention to detail is vital."

STEPS IN SALES SCHEME

The first step was to draw off from the meter lists a complete set of prospect cards and to file these cards by streets. Next the advertising, which consisted of a simple imitation pen-written postcard, was prepared, addressed and similarly assorted. Two or three days in advance of actual solicitation the advertising was started, a sufficient number of the postcard ads being sent out each day so that the prospects received them just ahead of the salesmen's calls; thus the campaign was kept fresh.

The salesmen were given about forty of the prospect cards each day, at the end of which the men were required to report upon and turn in cards constituting the previous day's stint. One of three things happened to these turned-in cards: If the prospect bought, the prospect card was attached to the order; if the prospect was seen but could not be interested, the prospect card was placed in a "finished" file; if the prospect was not seen, or if the salesman considered it worth while to call back, the card was returned to the live prospect file to be worked over at the proper time. This method is simple, yet it gives an absolute check upon the progress of the solicitors' work.

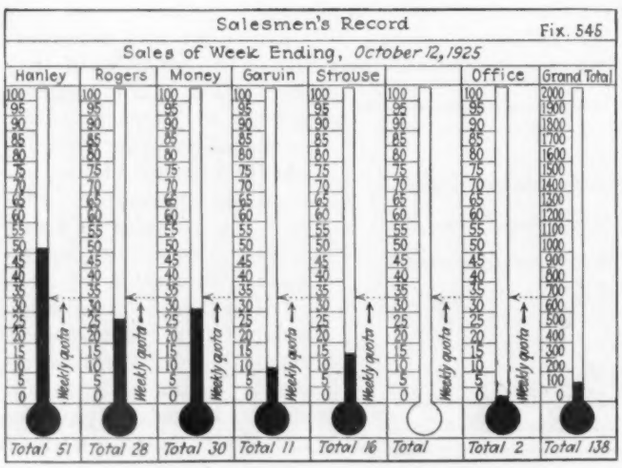


CHART OF WEEKLY QUOTA AND SALES

Orders were taken upon a combination order-and-inspector's-permit form, a separate signed order being required for each individual unit sold. When these orders were turned in, they were stamped with a rubber stamp and then sent to the credit department for approval.

A point to note here is that this rubber stamp form on the back of the customer's original signed order constituted a complete step-by-step record of the transaction; it was the key to the whole system and enabled the company to know at a glance exactly when and by whom any movement in connection with that individual job took place. It eliminated confusion.

When orders had been approved for credit, the contractor's installation order was made out in triplicate, one copy being kept for record and two copies being given to the contractor. The installation having been completed, both customer and contractor were required to sign one copy of the installation order, and that copy was returned to the company and filed with the original customer's order. The contractor kept the third copy for his records.

Mr. Round developed also a logical and thorough method of recording orders, payments to salesmen, payments to contractors and charging instructions to the accounting department, all with simple provisions to take care of cancellations and removals. The obvious purpose of this routine was to avoid confusion and to provide for prompt and trouble-proof handling of every question regarding any order, for the instant adjustment of any possible complaint from whatever source. "A sales campaign will run smoothly if it has a track to run upon," says Mr. Round. "Our system is nothing more nor less than a smooth track."

SALESMEN'S COMPENSATION

The retail price of the New Castle bedroom unit was $6.95 on time payment or $6.50 cash in ten days. Of this the salesman received $1 per unit up to a weekly quota of 35 units; if he exceeded this quota, his commission was $1.25 per unit. Thus a man selling 35 units in a week received $35, but if he sold 36 units he received $45 in commissions. This scheme of compensation provided a big incentive for good men—and it is Mr. Round's conviction that no other kind of men should be employed on central-station campaign work.

Commissions were paid the first week on the basis of orders turned in; thereafter, on the basis of orders less any cancellations or removals chargeable against the man's previous sales. The average sales through the campaign—omitting from consideration about two weeks in which holidays occurred—were a trifle more than 35 units per man-week, which indicates how accurately the quota was predetermined.

An interesting sidelight on campaign management is revealed in the chart of man-week performance. The New Castle campaign was started with a crew of five men, whose sales averaged only 24 units the first week. This was so disappointing that an SOS was sent to the glassware manufacturer. Elmer Holland, sales manager of the Consolidated Lamp & Glass Company, responded in person, and due to the stimulating effect of his leadership, the man-week average immediately reached the quota. When that stimulation was withdrawn, however, three of the five men again slumped, the two others maintaining or exceeding their quota average. These two were retained permanently and the others dropped. "I cannot stress too strongly the necessity for

co-operation between the campaign director and the manufacturer; it is vital to success," declares Mr. Round.

Not included in the figures for the campaign were a number of interesting and profitable byproduct sales. In one case the salesman attempted to sell a unit to the priest of a Polish Catholic church; he succeeded so well that units were demonstrated and ten of them installed in the parochial school, with the result that the doctrine of better lighting was effectively "sold" to the whole Polish community. One of the salesmen, living in the Y.M.C.A. dormitory, installed a unit in his own room; the result was that 75 of the dormitory rooms were equipped. Similarly, a unit tried in a small dining room of the Y.W.C.A. resulted in the sale of twenty more campaign units and the changing of the entire lighting equipment of the building to modern fixtures and glassware.

The contractors also profited from byproduct sales while engaged in installing campaign units, the records showing the following additional equipment ordered: 37 switches and outlets, one kitchen unit, one bathroom unit, four bedroom units, one ball fixture, three living room fixtures, two dining room fixtures, two side brackets.

Following is a summary of the New Castle campaign results:

Total cards issued to salesmen	10,908
Total interviews by salesmen	8,586
Percentage of interviews to cards	78.7
Actual sales	1,306
Percentage of sales to interviews	15.2
Canceled previous to installation	208
Percentage of cancellations	15.8
Removed after installation	53
Percentage of removals	4
Net sales	1,045

The total merchandise sold by campaign salesmen amounted to $7,362.75, carrying a gross profit of $2,170.63. The estimated annual increase in current sales amounted to 45,844 kw.-hr., or an annual gross revenue of approximately $2,750, which is at the rate of 33 cents per annum per customer interviewed, or $2.13 per annum per customer sold.

BEDROOM-LIGHTING UNIT SOLD IN CAMPAIGN

Britain's Largest Generator for Manchester

THE Corporation of the city of Manchester, England, has placed a contract with the Metropolitan-Vickers Electrical Company, Ltd., Manchester, for a 55,000-hp. turbo-generator for its Barton power station. The new set is reported to be the largest installed in the British Isles. The weight of the generator will be more than 160 tons, the rotating part weighing 61 tons. The steam turbine will weigh 210 tons.

HOW A FIXTURE CAMPAIGN SHOULD NOT BE CONDUCTED AND THE CORRECT WAY

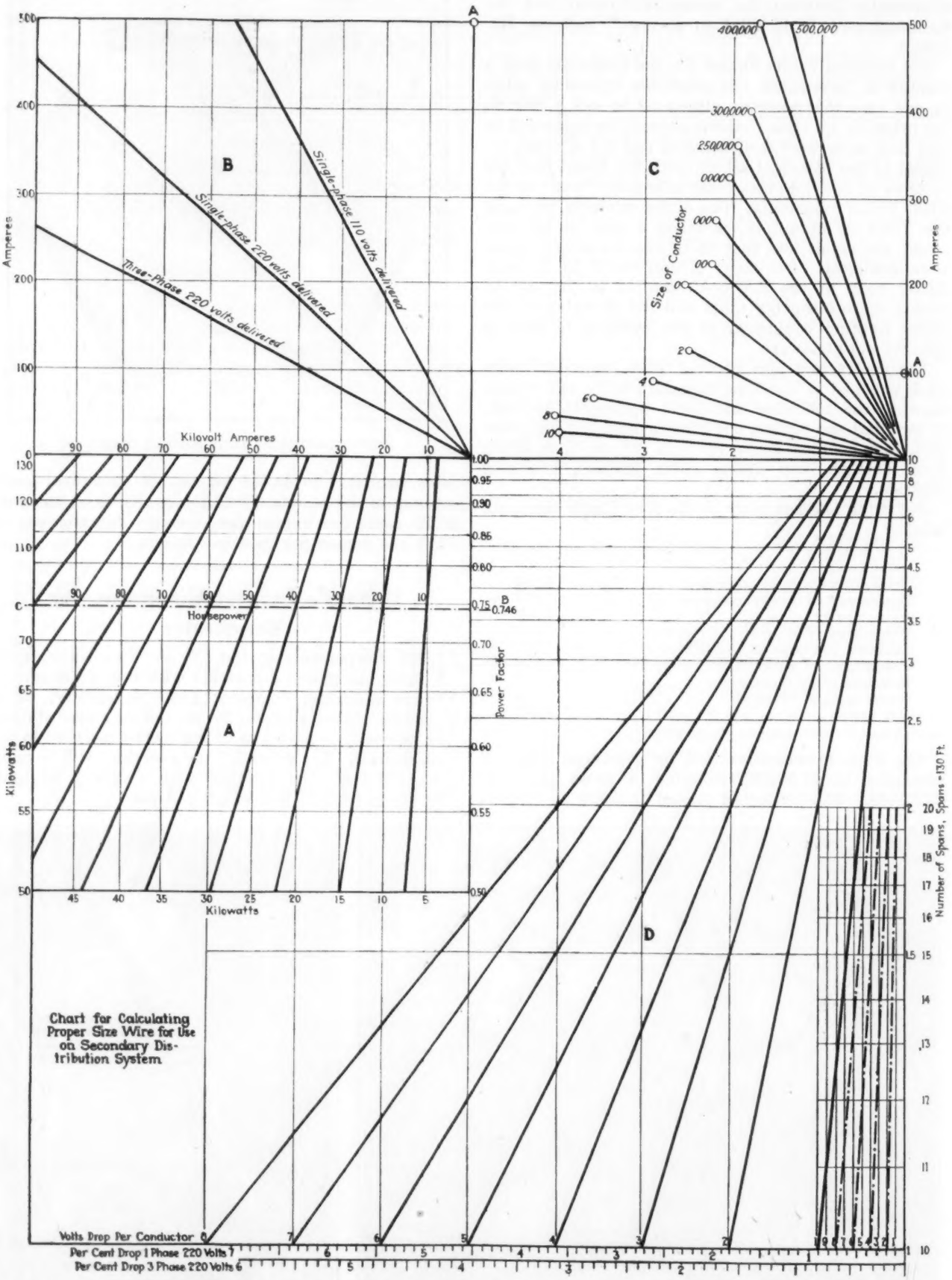

Amperes
Single-phase 110 volts delivered
Single-phase 220 volts delivered
Three-Phase 220 volts delivered
Kilovolt Amperes
Horsepower
Kilowatts
Power Factor
Size of Conductor
Number of Spans, Spans = 130 Ft.
Chart for Calculating Proper Size Wire for Use on Secondary Distribution System
Volts Drop Per Conductor
Per Cent Drop 1 Phase 220 Volts
Per Cent Drop 3 Phase 220 Volts

FIG. 1—SIZE OR CHARACTERISTICS OF SECONDARY DISTRIBUTION CIRCUITS CAN BE CALCULATED FROM THIS CHART, WHICH INVOLVES CONVERSION AND VOLTAGE-DROP DIAGRAMS NECESSARY IN THIS PROCESS

Graphic Solutions of Secondary Distribution Problems

Development of Simple Chart of Secondary Calculations from Elements of Load and Line Conditions—Method of Use of Chart and Application to Ordinary Secondary Distribution Problems

By MARTIN C. HUGHES

Professor of Electrical Engineering Texas Agricultural and Mechanical College, College Station, Tex.

THE calculation of distribution circuits is often a tedious job, especially for those whose theoretical engineering equipment has become rusted from disuse or for those who never had the opportunity of acquiring such equipment. Laying out a new circuit or rebuilding or extending an existing one is sometimes accomplished by rule-of-thumb methods, or even guesswork, simply to evade tiresome mathematics. The chart developed in this article is intended to supplant such abhorrent calculations and even those persons who revel in formulas and equations may find this chart a real time and labor saver after they have become familiar with its use.

There are four general problems in secondary distribution:

1. Given wire size, load and transmission distance, determine the voltage drop.
2. Given wire size, load and drop in voltage, determine the transmission distance.
3. Given load, transmission distance and drop in voltage, determine wire size.
4. Given wire size, transmission distance and voltage drop, determine permissible load.

THE KVA.-HORSEPOWER CHART

In stating the problems the word "load" was used. This load may be expressed in a number of units, but in electrical engineering it is usually in one of three forms. It may be expressed as horsepower, as kilowatts or as kilovolt-amperes. Irrespective of the unit, it must usually be reduced to its equivalent kilovolt-amperes (kva.) before proceeding with the solutions of the problems.

The following mathematical expressions give the relation between the units:

Horsepower = kilowatts ÷ 0.746. (1)

Kilowatts = kilovolt-amperes (kva.) × power factor (p.f.) (2)

Therefore, horsepower = (kva. × p.f.) ÷ 0.746. (3)

This equation contains three variable quantities. To represent it completely by means of a graph would require a diagram in three dimensions. For all practical purposes, however, it may be represented by a series of curves in two dimensions.

If, then, a set of curves for different horsepowers at various power factors are plotted they are as in Fig. 2. These curves are hyperbolas. They are rather hard to draw, and to interpolate for values between the curves is difficult. By changing the scale of either the kva. or the power factor to a hyperbolic scale* the curves will become straight lines radiating from a point so that a curve for any value of horsepower may be easily drawn, or the value desired can be read off the curve by laying a straight edge on the graph without drawing the line. The curves of Fig. 2 plotted with the power scale hyperbolic are shown in Fig. 1A. Point *A* is the center from which all the lines radiate.

Inspection of equation 3 shows that at the power factor 0.746, hp. equals kva. This gives a convenient

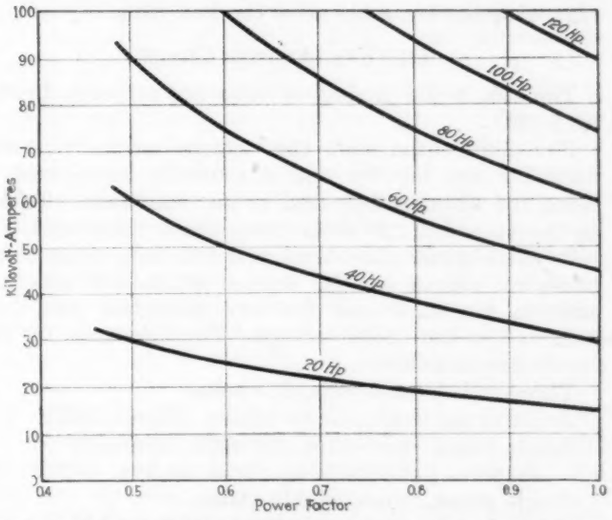


FIG. 2—KILOVOLT-AMPERE-HORSEPOWER CONVERSION CURVES THAT ARE DIFFICULT TO INTERPOLATE

relation to use in constructing a scale for getting values of horsepower other than those for which lines have been drawn. If a line at p.f. 0.746 is drawn, a scale along this line will be horsepower to the same scale as that used for kva. in constructing the graph. This is evident from Fig. 1A; for the 20-hp. line crosses the line *BC* on the vertical line that was designated as 20 kva. Similarly other hp. lines (60 hp.) cross the line *BC* on the vertical line designated as the kva. of the same value as the hp. sought (60 kva.).

It is evident, then, that if a hp. scale, duplicating the kva. scale, is put on this line *BC*, a curve for any hp. can be drawn by selecting the proper point on this scale and connecting it with a straight line to the point *A*.

With this chart, then, any relation among kva., hp. and p.f. can be solved. If it is desired to find the kva. for a load of 70 hp. at 0.6 p.f., the procedure would be as follows: Lay a straight edge on the chart so that it touches point *A* and intersects the hp. scale at 70 hp. The intersection of the straight edge with the 0.6 p.f.

*See article by H. E. Eisenminger, ELECTRICAL WORLD, June 2, 1923.

line gives the kva. when read on the kva. scale. That is 87 kva. If the same load was delivered at 0.8 p.f., the kva. would be 65.2. If it is desired to find the hp. of 75 kva. load at 0.7 p.f., proceed as follows: Run across from the 75 kva. scale line to an intersection with 0.7 p.f. line. Lay the straight edge on this point and point *A*. The point where this straight edge crosses the hp. scale gives the hp. (70.5). Other problems are similarly solved.

Another scale representing kw. can be added, which will be helpful in changing kw. at any p.f. to kva. This scale is constructed as follows (at 0.5 p.f., 1 kw. equals 2 kva.): On the 0.5 p.f. line a scale is constructed, which is twice the scale used for kva.—that is, 0.65 in. equals 20 kva. on the kva scale and 0.65 in. on the kw. scale equals 10 kw. This scale is shown in Fig. 1A at the top and center of the graph. With the scale *B*, problems involving kva., kw. and p.f. are readily solved as follows: Find the kva. for 25 kw. at 0.80 p.f. Lay a straight edge on point *A* and the 25 kw. point of the kw. scale. Where the straight edge crosses the 0.8 p.f. line read off the kva. (31.3).

Find the kw. delivered by a 35-kva. load at 0.6 p.f. On the 0.6 p.f. line pick out the point corresponding to the 35 kva. and then lay the straight edge on this point and point *A*. The intersection of the straight edge with the kw. scale gives the kw. (21).

THE KVA.-AMPERE CHART

The kva. is the product of volts and amperes divided by 1,000.

For distribution work the voltages used are usually fixed for one locality and are usually considered as being the voltages delivered to the customers. Taking as the standard 220 volts three-phase three-wire, 220 volts single-phase three-wire, and 110 volts single-phase two-wire, curves can be drawn which will give the amperes per conductor for any particular kva. load delivered at the above voltage. The equations for the curves are as follows:

Three-phase, three-wire, 220 volts:

$$\text{Amperes per conductor} = \text{kva.} \div (220 \times 1.73) \quad (4)$$

Single phase, three-wire, 220 volts, balanced:

$$\text{Amperes per outside conductor} = \text{kva.} \div 220 \quad (5)$$

Single phase, two-wire, 110 volts:

$$\text{Amperes per conductor} = \text{kva.} \div 110 \quad (6)$$

The graph for each of these equations is shown in Fig. 1B.

To get the amperes per conductor for any kva. load, then, select the kva. on horizontal scale and run up vertically until it intersects the diagonal for the system in question, then read the amperes on the vertical scale to the left of the intersection—that is, 50 kva., three-phase, 220 volts requires 131 amp. per conductor.

THE AMPERE-VOLT DROP-SPAN CHART

The proper size wire to use to carry a given current depends on a number of quantities:

1. Allowable temperature rise on conductors. This is chosen the same as prescribed by the fire insurance underwriters, who specify the maximum current that a given wire can safely carry.

2. Allowable voltage drop in the conductor. This is fixed by good service conditions or by economic laws. The maximum drop in voltage for good lighting service on secondaries is usually taken as 3 per cent. Except in districts of very low load density the allowable drop from an economic standpoint will be close to, but usually less than, 3 per cent.

3. For low-voltage distribution work it is usually accurate enough to assume that the reactance of the line is zero. When so considered, the voltage drop in a line is the product of the current and the resistance of the wire. The resistance of the wire is equal to a constant times the length divided by area of the wire.

$$\text{Volts drop} = IR \quad (7)$$

$$R = \rho l \div a \quad (8)$$

$$\text{Therefore, volts drop} = I\rho l \div a \quad (9)$$

For a given wire the area is constant and if a given length, say a pole span, is selected as a standard of measurement, ρ being a constant depending for its value on the character of wire used, then for a given size wire of a given length, the resistance may be taken as a constant "*K*," and

$$\text{Volts drop per span} = KI \quad (10)$$

For distribution work the most convenient length to use is the pole span, which on various systems is different, but is usually standard for any given system (use 130 ft., which is standard with most companies). A set of curves can then be plotted, giving volts drop per span against amperes for various sized wires (Fig. 1C). The curves stop at the value of current set by the underwriters as the maximum carrying capacity of the wires. The equation for these curves is:

$$\text{Volts drop per span} = 1340\, I \div a \quad (11)$$

Where a is the size of wire in circular-mils.

TOTAL DROP-VOLT DROP-SPAN CHART

There remains one other operation in solving any of the above problems, that of getting the drop for the total number of spans when the drop per span is known or getting the drop per span when the total allowable drop is known.

$$\text{Volts drop per span} = \text{total drop} \div \text{number of spans} \quad (12)$$

This equation gives a set of hyperbolas of the same type as Fig. 2. They also can be reduced to straight lines by applying a hyperbolic scale to one axis. The most convenient relation results when the hyperbolic scale is applied to the axis of spans. These curves plotted with the hyperbolic scale so applied are shown in Fig. 1D.

It will be noted that these curves all radiate from point *A*, which corresponds to infinite number of spans. From ten spans to infinite spans occupies a very small part of the scale. To get accurate reading of more than ten spans, then, we have to resort to some other expedient. We could get twenty spans by halving the voltage drop scale and multiplying the span scale by 2. Suppose that we desired to find from these curves the volts drop per span for fourteen spans with a total drop of four volts per conductor; read the volts drop per conductor on the two volts drop curve at seven spans; this gives 0.286 volt drop per span. Similarly for 30 spans, divide the volts drop scale by 3 and multiply the span scale by 3.

A more convenient multiplier to use is 10, so another scale has been drawn in, using one-tenth volt drop per span and ten times the number of spans. This has been carried only up to twenty spans because it is seldom, if ever, necessary to carry distribution secondaries more than twenty spans.

Here, then, is a set of four curves which, when taken

together, will solve any of the four general problems outlined at the start. These four curves are combined into one chart, conveniently arranged to solve the problems outlined.

EXAMPLE OF SOLUTION OF PROBLEM

A 10-hp. load at 0.8 p.f., three-phase, 220 volts, is to be transmitted a distance of eight spans with a voltage drop of 3 per cent. Start on the 10 hp. point on line *BC*; move on the 10 hp. line to the left until it intersects the kw. scale at 7.46 kw. This gives the kw. to be transmitted. To get kva., take intersection of line with 0.8 p.f. line and then move horizontally to the right to the kva. scale (9.33 kva.), or proceed without reading kva. to the three-phase diagonal. Here read the amperes (24.6 amp.), or move down on the vertical line without reading them. To find what size wire to use for a 3 per cent drop in eight spans, start in the lower left-hand corner, select the 3 per cent line for three-phase circuit and move down it till it crosses the eight span line; here read the volts per span (0.45 volt) or move horizontally till the horizontal line intersects the ampere line run down before. The larger of the wire sizes nearest the intersection is the one which will limit the drop to 3 per cent. The smaller wire will give a greater drop than 3 per cent. Number 2 wire will not limit the drop to 3 per cent, so number 0 would be called for from the chart. The solutions of other problems are similar.

Barrier-Type High-Voltage Terminal

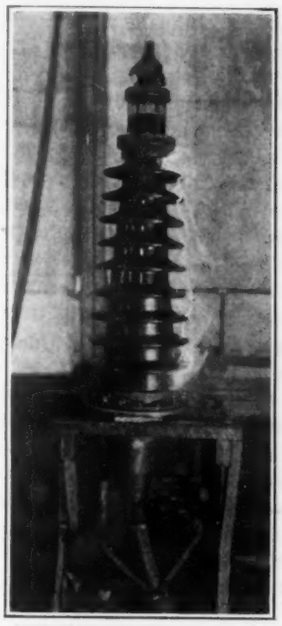
Flaring Oil-Filled Metallic Shield Joined to Cable Sheath Relieves and Redistributes Stresses at End of Sheath, Increasing Puncture and Flashover Voltage

BY A. M. MEYERS
Standard Underground Cable Company, Pittsburgh, Pa.

HIGH-VOLTAGE oil-filled terminals making use of the barrier type of construction invented by R. W. Atkinson, chief electrical engineer of the Standard Underground Cable Company, have recently been developed. This construction has been used for some time for laboratory tests on high-voltage cable, and when the growing demands for higher operating voltages made it necessary to supply terminals with increasingly high flashover and puncture values, it was decided to develop this type of terminal into a form more readily applicable to commercial installation.

The fundamental feature is the use of an oil-filled metallic shield joined to the end of the cable sheath and flaring from the cable diameter in such a way as to relieve and redistribute the stresses at the end of the sheath so there will be a high resistance to puncture or flashover. The puncture strength of the oil is greatly increased by breaking it up into a number of films by the use of concentric micarta tubes surrounding the conductor insulation.

In none of these terminals, when subjected to repeated dry flashovers and long-time high-voltage tests, did failure occur by puncture of the barriers. On the experimental 75-kv. terminals attempts were made to obtain puncture by immersing two terminals mounted on a short length of 66-kv. cable in oil. Internal flashovers

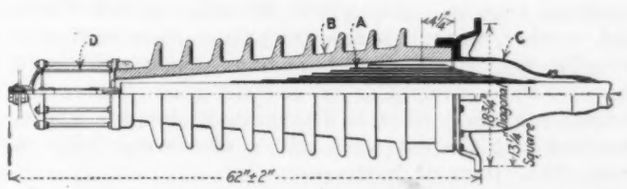


A WET FLASHOVER AT 330 KV. ON ONE OF THE EXPERIMENTAL BARRIER-TYPE TERMINALS

along the surface of the cable insulation were obtained at very extreme voltages, but half a dozen tests failed to puncture the barriers.

Three sizes of terminals have been developed for operating voltages of 75 kv., 110 kv. and 132 kv., respectively. The general construction and appearance are the same for all voltages. The mounting of the micarta barriers in a separate internal bell greatly facilitates assembly and makes it possible to approach as closely as desired to the theoretical shape with the trumpet-shaped ground shield. As indicated in the drawing, the inner micarta tube fits quite closely around the conductor insulation, and projects below the end of the copper ground shield. The end of the cable sheath is belled out slightly so that the lower end of the ground shield enters it. Electrical and mechanical connection between the two is made by soldering at three or four points. The upper end of the ground shield flares out to a diameter slightly smaller than the inside bore of the porcelain weather casing and extends several inches above the lower end of the porcelain. The exact height of the upper edge may vary considerably without seriously affecting the characteristics of the terminal. This feature is of great importance in installations, as it makes unnecessary the exceeding exactness in the length of lead sheath removed, which is required in designs utilizing the terminal bell to furnish the flaring extension at the termination of the cable sheath. In this construction the terminal bell becomes a mere oil container, and the wiped joint between it and the cable sheath can be made after the assembly is completed.

Another feature that not only takes care of unavoidable inaccuracies in cutting but also compensates for



ASSEMBLY DRAWING OF 110-KV. TERMINAL

The terminal is made up in effect of four units: (a) the nest of micarta barriers that are mounted in the spun-copper ground shield, (b) the porcelain weather casing, (c) the brass terminal bell, and (d) the glass oil reservoir.

66-KVA. BARRIER TERMINAL BEFORE GROUND SHIELD IS APPLIED

unequal expansion between the cable and the terminal itself is the slip joint between the upper portion of the stem and the lower tubular portion that is soldered to the cable conductor. This joint, because of its design, imposes an exceedingly low-resistance contact and still permits a total movement of many times the amount that would ever be found necessary in service.

The oil reservoir on these terminals is made of clear Pyrex glass, thus affording a most efficient telltale in case of the lowering of the oil level due to migration into the cable, leakage or other cause. The extremely high visibility of this reservoir makes it possible to observe the slightest oil movement from a considerable distance in any direction. The terminal stem is brought through the top casting of the oil reservoir by means of the solid hood-nut seal construction which has been so successful on some of the later designs of Standard outdoor terminals for voltages of 16 kv. and over. No magnetic materials are used anywhere in the terminal.

Work is now under way to obtain the higher flashover value that will be called for on the still higher voltage cables that will undoubtedly soon be demanded.

Letters from Our Readers

A Customer's Experience with Extending Power Lines in Rural Communities

To the Editor of the ELECTRICAL WORLD:

Four months without power "down on the farm" is enough to make any city-bred citizen sing hymns to Ampère and Faraday. Carrying water, reading by uncertain kerosene light, toting the storage battery to town to keep the radio going for a summer is an impressive lesson in the value of electricity. This was my unexpected experience last summer, unexpected because I anticipated no great difficulty in obtaining electric power. The farm, which I occupied as a literary workshop last summer, was only a half mile from a power line on a state highway, and I did not delay in making application to have the line built. My experience taught me many things regarding power companies and their merchandising methods which seem extraordinary to one who is not familiar with the problems of the business.

To find that electricity must be "sold" in rural communities, even in places within 50 miles of New York, and, further, to find that power companies almost universally neglect the most obvious opportunities to increase the consumption of electricity and foster the extension of their lines, is a surprise to any one who is familiar with the extensive selling efforts obtaining in competitive lines of business.

No business without the advantage of monopoly through franchise would survive in face of a record such as attended my effort to secure power this summer. Briefly, this is the record, which I found, upon investigation in various counties of New Jersey, Connecticut, Massachusetts and Pennsylvania, to be quite the average rate of doing business:

June 18.—Application for power.
June 19.—Inspection of my location; referred to contractor in nearby town to have line built.
July 20.—Power company agreed to build line, paying half expense and exacting guarantee; accepted.
July 31.—Power company makes new proposal, exacting higher guarantee but refunding investment in three years if guarantee reached; gave check with understanding work was to begin in week or ten days.
Sept. 4.—Work started but abandoned after two days.
Oct. 5.—Line completed.
Oct. 9.—Meter installed.
Oct. 15.—Moved back to the city.

Seventeen weeks to have twelve poles erected, which gave only six days of service instead of four months!

Having an investigative turn of mind, I determined to find out whether this was unusual treatment of a customer who applied for power-line extensions. I found that my application had been pushed ahead of schedule because of my persistence in following up the company; that some people in similar situations had waited three years for action; that several real-estate developments with a dozen or more houses built and occupied had waited as much as a year for a three-quarter-mile extension; that the company in question was no slower than half a dozen others operating within an equal distance of New York.

In my seventeen weeks of waiting I learned some of the difficulties under which power companies labor. Because of the great fluctuations in construction work, it is not profitable to maintain large construction forces. Maintenance troubles come in bunches so that work cannot be systematically planned. Demands for new construction are highly seasonal. No construction work is undertaken except upon application of consumer, nor is any effort made to influence home owners along new or old lines to wire their homes for electricity.

If furnishing electric power were a competitive business, these varying conditions would not be passed to the consumer to bear. Power companies would take the initiative in building new lines in order to be ahead of their competitors. New construction would not lag behind such developments as telephone and road improvement. Sales forces would be employed to open up locations for new lines and to insure maximum utilization of old ones. Electricity would be sold, not begged for. A steady volume of new construction would be built up and maintained as other businesses are, sufficient to warrant the maintenance of adequate service facilities and personnel.

In my own case, for example, the half-mile line passed within ten feet of one potential consumer, while 150 ft. beyond its end was another. Yet the company did not make the slightest effort to make its investment in my line more profitable by soliciting the business of these two potential consumers. I asked the farmer in front of whose home my line passed whether he would take advantage of the facilities offered by having his home wired. "I have been using kerosene lamps for eighteen years," he answered, "and I do not see any sense in throwing away those lamps which have served me so well." By driving along the road and observing the number of houses wired and unwired, I discovered there were scores of seemingly prosperous homes not wired for electricity.

In the county was an active Delco lighting-plant salesman who had a somewhat more difficult problem than an electric power company in selling his commodity, yet in two years he had sold nearly 150 plants, costing from $300 to $1,000, in that territory. He meets the same opposition to electricity with salesmanship. "Occasionally," he told me, "I meet a particularly unprogressive 'prospect' whom I know to be financially well able to afford one of our lighting plants. I have closed the sale on one or two occasions by mounting my lighting plant on a truck and driving up to the farm in question in one of our long winter evenings.

I have a long extension cord and I carry this right into the living room. I give the man a newspaper to read and ask him to bring in his brightest kerosene lamp. Then I make him move off until he can just barely make out the type. I blow out this lamp and in a second or two turn on my electric light. Usually it makes the sale."

It is difficult for the layman to understand why the extension of power lines should almost invariably lag behind the appearance of other improvements. The motor car and bus have solved transportation problems in location up to now unsuitable for development. The power line and telephone are the only requisites necessary to enable the installation of conveniences equaling those of a city home. Electric power brings with it the possibility of the automatic water plant, lighting and the entire range of household conveniences. In cities power companies make intelligent efforts to foster the use of conveniences such as fans, heaters and washing machines, but in rural districts they leave this largely to chance.

The thing that keeps the world progressing is the customer. There are few fields of endeavor in which he is regarded with less interest than in the merchandising of power in rural communities. He seems to be asking a favor instead of offering his custom. Other businesses make aggressive efforts to find new customers. Power companies are satisfied to wait for theirs.

It seems to me that rural lines not paying large revenues could be made much more productive by sensible selling effort. By active co-operation with electrical contractors, by the establishment of credit facilities so that the wiring of homes and the purchase of household appliances can be done on the installment plan, new consumers can be found and old ones made more productive. By systematic study of home building along highways and active solicitation as soon as a sufficient number of potential users of power are found lines could be extended without waiting applications by consumers. The stimulation of new construction would thus warrant more extensive equipment and a larger construction personnel so that applicants could be more promptly satisfied. EDGAR H. FELIX.

Allendale, N. J.

Charging for Servicing

To the Editor of the ELECTRICAL WORLD:

I wish to commend the article by G. M. Dwelley on charging for service repairs published in your issue of Nov. 20. Mr. Dwelley is absolutely right, but he does not go quite far enough. I think that in our anxiety to be fair to the public and to see they get a fair return we make our guarantees entirely too long. Then we have to live up to them, sometimes to our own harm. It is not so in other businesses. Purchasers of automobiles, for instance, get few, if any, guarantees and very little free service from the dealer. They get virtually no guarantee on parts or tires. Yet the public does not seem to complain.

It has been the practice here to charge for all service not called for under guarantee, and this charge, whether on merchandise sold by our company or merchandise sold by outsiders, takes the form of list price for material plus workman's time. After years of such practice we have yet to find any one who seems to feel that the treatment is unfair. FRED P. STRONG.

Carolina Power & Light Company,
Sanford, N. C.

Finding the Point Where Railroad Electrification Will Be Economically Possible

To the Editor of the ELECTRICAL WORLD:

In the Nov. 27 issue of the ELECTRICAL WORLD there is an editorial entitled "Can Railroad Electrification Be Expedited?" in which the possibility of transferring the first cost of electrification from the railroad company to either utility companies or manufacturers of electrical traction machinery is suggested. If the difficulty of initial cost is assumed as being insurmountable by the railroad companies on account of their lack of funds, then your suggested solution is something to be taken quite seriously. But if the situation is considered from an economical standpoint—i.e., Can electrification justify such enormous initial expenditures? or, in other words, Can electrification pay dividends on capital invested?—then it will not matter who undertakes to pay the initial cost of electrification. If it does not pay, it cannot be undertaken.

In 1918 I made quite an extensive analysis of electrification problems, and my conclusions were as follows: Electrification, or railroading in general, may be subdivided into three different classes, namely, short-distance small-traffic, short-distance large-traffic and long-distance. It is always possible from available information concerning a given railroad system to find out to what class a given portion of the system belongs.

The distinguishing feature of the first class would be a small railroad trunk, with only one or two branches, going from one place to another; the second class involves a multiplicity of lines radiating from one big center to other large centers, and the third class involves a long branch connecting a small number of industrial centers widely separated from each other. It can be seen that in the first class the line and contact-collecting apparatus as well as the traction machinery would not be used enough to pay dividends on the sums involved. The great property of the second class is that the generating machinery can supply power to any point of any one of the branches, so that when a locomotive stops operating at any point of one branch it is more than likely that another one will start somewhere else on the system; thus a continuous load is approached on the generating system. The fact that such a railroad system connects large centers of industry guarantees that a large number of trains will run over the system and that dividends on the transmission lines, substations and collecting apparatus will be paid.

It was also found in my investigation that if electrification must be used the generation must be as follows: Generation for the first and third classes must be made on the traction unit, as, for example, Diesel-electric locomotive and turbo-electric locomotive, and for the second class electrification by trolley is the most economical.

It seems to be quite a common occurrence that steam traction and electric traction are discussed by themselves without reference to the system on which they are to operate. I need only cite the cost of electrification of the Chicago, Milwaukee & St. Paul Railroad (mentioned in your paper recently as being $30,000 per mile for the electrification only) to show that it is absolutely necessary to establish an equation whereby the point can be found at which any given railroad system may be electrified economically. But it seems that no one has, as yet, taken that into consideration.

PANFILO TROMBETTA,
Electrical Engineer.

Schenectady, N. Y.

Central Station and Industrial Practice

Control Reduces Hazards of Oxygen-Hydrogen Production

IN ORDER to prevent any mixing of electrolytic hydrogen and oxygen gas through reversal of the current a reverse power relay is used in the plant of the Magnolia Gas Products Company, Houston, Tex., to shut down the equipment when the current changes its direction. As a further provision in case of accidents, an emergency push button is used. Depression of this button first opens the air circuit breakers and afterward the main incoming line oil circuit breakers. The push button actuates an instantaneous undervoltage relay, which, in turn, accomplishes this result.

One relay is arranged to de-energize the undervoltage release on the air circuit breaker and thus open the breaker when the relay coil is de-energized. When this de-energizing occurs, a second set of contacts is closed, de-energizing an instantaneous relay located on the main incoming-line panel. This, in turn, opens the circuit of the low-voltage release on the incoming-line panel. Thus when the push button is depressed, the voltage relays on the direct-current panels drop and open the air circuit breakers. The rotary panel voltage relays then energize the alternating-current panel voltage relay and open the main breaker.

By this method any possibility of overspeeding the machine, reversing polarity, etc., is avoided, because all the direct-current air circuit breakers will open before the alternating-current oil circuit breakers. When leaving the plant, the operators merely have to push the button and the plant will shut down.

Another interesting feature of this installation is an emergency throwover switch, arranged so that two small emergency lighting transformers are connected ahead of the main incoming-line oil circuit breakers, in case of emergency, when the main incoming-line oil circuit breaker opens. General Electric equipment is used throughout.

Relay Fuse for 110-Kv. Substations

Necessity for Inexpensive Protection Leads to Development of Combination Fuse and Relay with Auxiliary Heating Coil on Washington System

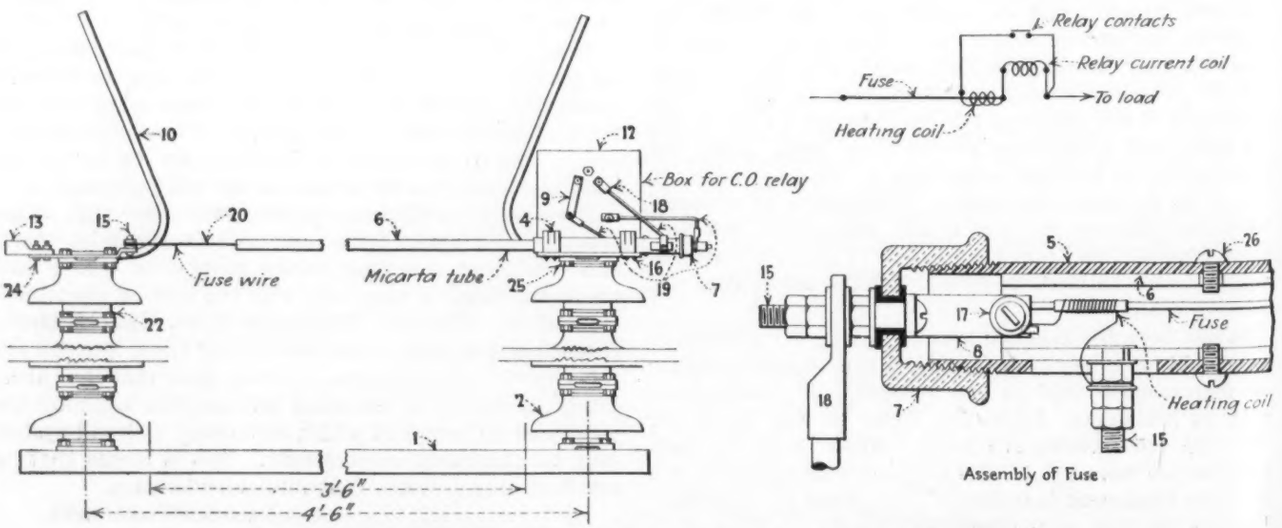
BY LESTER R. GAMBLE
Assistant Engineer Washington Water Power Company, Spokane, Wash.

IN THE development of 110-kv. transmission networks it is often necessary to connect to such systems small distribution substations ranging in capacity from 300 to 1,500 kva. These smaller substations do not usually justify the expense that is necessary in providing protective switching equipment, with the result that some type of fuse cutout is provided as an alternative.

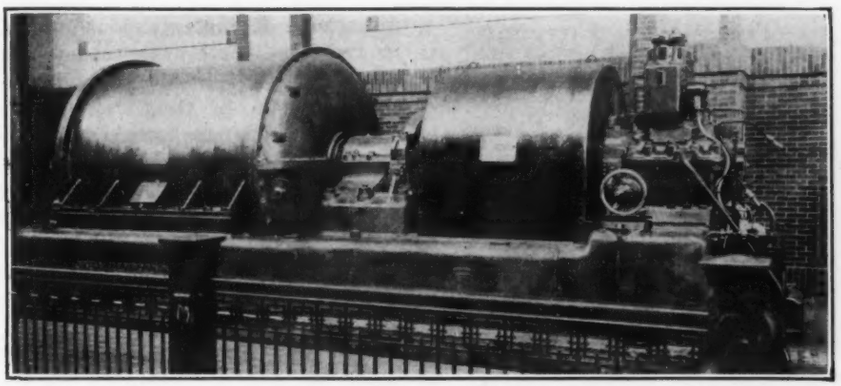
Certain factors must be taken into account when using a fuse on small 110-kv. substations. First, it is necessary that the fuse give proper protection and at the same time be of sufficient diameter to prevent deterioration by corona. Second, it must have sufficient ampere capacity to provide the desired degree of selectivity.

A simple open-type fuse designed by the Washington Water Power Company satisfies these requirements. The fuse was made primarily for overload protection on a solidly grounded Y-delta transformer bank, although its use may be extended to give protection on any small bank of transformers regardless of how connected.

The fuse is mounted on two stacks of six post-type insulators. On one post is mounted a small sheet-metal cabinet, containing an induction-type relay and a clip, into which one end of a micarta tube is secured. A fuse wire of not less than 20-amp. capacity is placed in the tube and



DETAILS AND CONNECTIONS OF 110-KV. RELAY FUSE FOR SMALL SUBSTATIONS



7,000-KW. TURBINE-GENERATOR OPERATING AT 1,200 LB. STEAM PRESSURE, INSTALLED IN THE LAKESIDE PLANT OF THE MILWAUKEE COMPANY

secured at the opposite insulator post by a binding screw. At the clip end a small heating coil having the same impedance as the relay current coils is slipped over the lead fuse wire. This heating coil is connected to the tripping circuit of the relay.

Under normal operation the main-line current passes through the fuse and relay coils to the load. Overload protection is secured by the proper setting of the relay, which, when called upon to function, closes its contacts, shunting part of the load current through the heat coil and melting the fuse wire, thereby opening the 110-kv. circuit. The fuse is equipped with horns, so the arc established is readily extinguished.

BILL OF MATERIAL

Item	No. Req.	Description
1	1	Base—8-in. channel.
2	12	Insulator J-D.A. 254.
3	1	Steel plate.
4	2	Clips.
5	1	1-in. galvanized iron pipe.
6	1	Micarta tube ¾ in. x 48 in.
7	1	1-in brass pipe cap.
8	1	Copper strip.
9	1	Copper link.
10	2	Horn gaps.
11	2	Iron clips.
12	1	Relay box.
13	2	Terminal lugs.
14	1	Brass strip
15	3	No. 16 x 1¼ in. brass machine screws.
16	4	No. 10 x ⅝ in. brass machine screws.
17	1	No. 10 x ⅝ in. brass machine screw.
18	6	Copper lugs.
19	3	Pieces 7 strand No. 8 copper wire.
20	1	Special fuse.
21	1	C. O. relay.
22	53	¼ in. x 1½ in. galvanized machine bolts.
23	1	¼ in. x 1 in. cap screw.
24	8	⅜ in. x 1 in. galvanized machine bolts.
25	4	¼ in. x 1½ in. galvanized flat-head machine bolts.
26	4	No. 10 x ¼ in. machine screws.

The fuse is yet in the experimental stage and has not been placed in actual operation. Further details as to the adaptability of the fuse to the requirements mentioned will be discussed in a subsequent article.

1,200-Lb. Pressure Turbine for Milwaukee

A STEAM turbine-generator that uses steam at a pressure of 1,200 lb. (three to four times the average pressure of today's generating plants and, with one exception, double the pressure in use in any station), has just been put in operation by the Milwaukee Electric Railway & Light Company. The one exception is the 3,000-kw. turbine-generator in the Edgar station of the Edison Electric Illuminating Company of Boston, which also operates at 1,200 lb. pressure. The Milwaukee machine sets a record, however, in that it has a capacity of 7,000 kw. Both are of General Electric design and manufacture.

The Milwaukee turbine receives steam at a temperature of 720 deg. F. It exhausts at 320 lb. pressure into the station main, serving several 30,000-kw. machines, where more of the energy in the steam is extracted and utilized.

A pressure of 400 lb. is now common in central stations, with some operating well above this figure. However, 600 lb. is the maximum except in the cases of these two 1,200-lb. pressure turbines.

Airplane Repair Service on Transmission Line

Usual Conveyances Blocked by Snow, but Line Fault Is Located and Repaired in Record Time

BY M. D. LESLIE
General Manager Electric Service Company, Dodge City, Kan.

RECENTLY the airplane proved its usefulness in transmission-line repair work at Dodge City, Kan. A severe blizzard arrived Sunday night, Nov. 7, a wet snow being accompanied by a very high wind. About 3 o'clock in the morning the transmission line to Bucklin, Kan., failed and a repair crew, consisting of two men, left immediately in a specially equipped Ford roadster to make the repairs. But the snow had drifted badly, and the men were stalled about six miles from Dodge City. Other men with horses and wagon were sent out to their assistance, but the entire outfit was snowed in, leaving the transmission line still unrepaired when night time came.

Next morning the services of the local airport were solicited and the pilot expressed an opinion that he could be of assistance. Because the weather was quite cold, some time was lost in preparing the plane for flight, and it was not until about 11 o'clock that the plane left Dodge City.

No lineman accompanied the airplane on the first trip, there being some question whether a successful flight could be made and whether it would be possible to see the transmission line. The plane returned to the field within 38 minutes and reported that the break had been located 22 miles from Dodge City and that the plane would be able to land near the point of failure with the necessary repair equipment.

The plane left with one lineman

PILOT, LINEMAN AND AIRPLANE USED IN EMERGENCY TRANSMISSION-LINE INSPECTION

at 12:40 p.m., with instructions to patrol the entire transmission line, involving a flight of about 90 miles before an attempt should be made to repair the break reported, because there might be extensive damage in other locations. The plane flew to Ford, Mullinville, Bucklin and Kingsdown and returned to a point near the city of Ford, where the break first reported had been located. The break was repaired in about an hour and the plane returned to Dodge City.

Inasmuch as there was no telephone at the flying field, it was necessary for the repairman to drive into Dodge City and report, consuming approximately twenty minutes. The total time for the repair trip from the time the lineman left the office until he returned was two hours and 50 minutes.

The plane was an Eaglerock biplane equipped with a 90-hp. Curtiss motor. It was found that the plane could fly successfully at an average height of about 30 ft. above the transmission line. Consequently the inspection was quite easy to make. In fact, the lineman reported that better vision was obtained from the plane than could be obtained from the ground in an automobile. He also reported that insulators having defective tops were quite conspicuous.

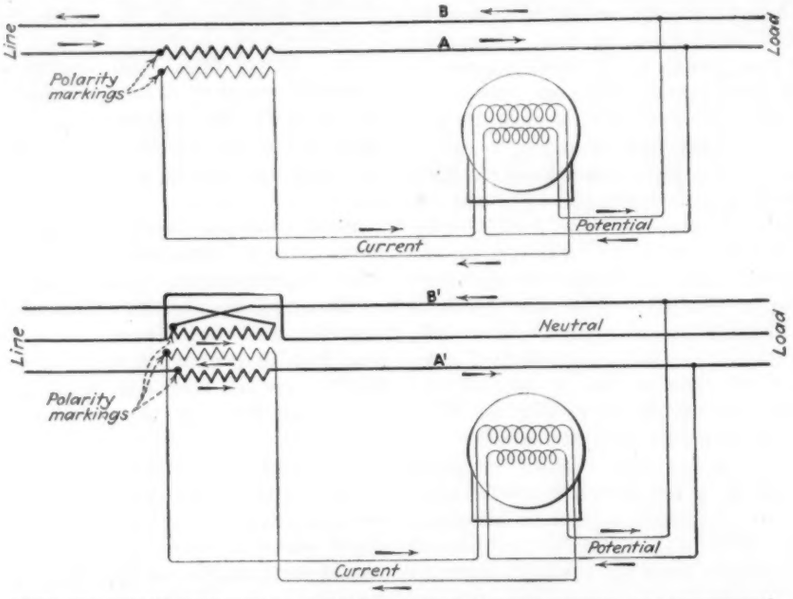
It is felt that this repair service was so successful that whenever bad road conditions prevail in the future, the service of an airplane will be solicited to make an inspection of the transmission line.

Three-Wire Current Transformer Installations

BY LEROY L. SHUTES

THE line connections for three-wire current transformers to obtain correct meter registration do not seem to be clear to many meter men if the numerous cases of wrong installation constitute any evidence. The trouble seems to lie in the distinction between polarity markings and line connections.

The manufacturers identify one primary and one secondary lead of each transformer with a color or some other marking, but the former seems to be the one generally used. The relation of these marked leads to the instantaneous direction of the current is always the same if the current is flowing in the transformer through the marked primary lead and out the unmarked one. The secondary current would be out of the marked lead and back to the unmarked one.



INSTANTANEOUS CURRENT IN TWO AND THREE-WIRE CURRENT TRANSFORMERS

The trouble sometimes found in three-wire transformer installations is evidently due to a misunderstanding of the proper connections on the primary side. The marked leads for polarity are always line-side in on single-phase two-wire or polyphase installations, but this does not apply to single-phase three-wire layouts. If the leads marked for polarity on a three-wire current transformer are correct, the question comes up, Why are they not line-side in, the same as any other transformer installation?

The illustration herewith shows directions of instantaneous current in two and three-wire transformer setups. In the case of the former, shown above in the drawing, the polarity markings agree with the line and load terminals. In the case of the second, however, it is seen that the polarity markings are in disagreement with the convention established by the first case. The marked terminal on one primary is line and on the other it is load.

From the accompanying sketches it is self-evident that the instantaneous current must flow in the direction indicated by the arrows and that when wire A' carries current in the direction shown, wire B' must have current in the opposite direction, both sides of the circuit being loaded. Consequently, the instantaneous direction of current in wire B' is from the load to the line, and the load side of this wire must be connected to the polarity-marked lead of one side of the current transformer in order to permit current in the same direction through both primaries to combine their effects on the secondary winding and produce correct rotation of the watt-hour meter disk.

Some manufacturers reverse one of the primary windings, bringing the polarity markings on opposite ends of the primary wires. This greatly facilitates installations.

If both polarity-marked terminals were connected to the line side, the meter could rotate only on unbalanced loads and would not rotate on exact balance of load. In that case rotation could be either forward or backward, depending on which leg of the transformer was carrying the heavier load.

If the load were badly unbalanced and the side carrying most of the load were connected in the circuit on the primary leg that was producing forward rotation on the watt-hour meter, it is possible this condition might go undiscovered for a considerable period and a substantial financial loss to the power company would result.

Electrifies Fastest Steam-Driven Car Dumper

THE fastest steam-driven dumper now on the Great Lakes, located at Conneaut, Ohio, will be the first electrification in this country of an existing steam-driven car dumper of the lifting type. Likewise it will be the second electrically operated

dumper on the Lakes, the first being recently completed at Toledo.

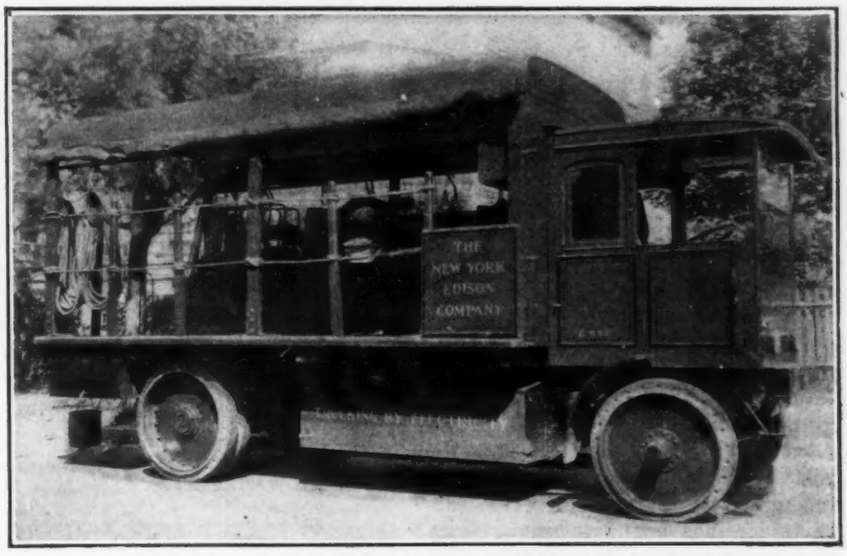
The present dumper is a McMyler-Interstate machine unloading cars up to 100 tons capacity loaded with coal for Great Lakes ports. With the change-over to electricity a reduction in operating expense and an increase in efficiency are expected. Cars containing 70 tons of coal each will be dumped at the rate of 50 per hour.

The electrical equipment will be furnished by the General Electric Company, including a motor-generator set, motors and control. The dumper cradle will be driven by two 450-hp., shunt-wound, mill-type motors governed by the Ward-Leonard method of control, either from the "mule" operator's house or the chute operator's house. A transfer switch will prevent the operation of the cradle from more than one point at a time. The "mule" will be driven by a single 450-hp., shunt-wound, mill-type motor controlled from the "mule" operator's house by a similar system.

Unit Costs on Ornamental Street-Lighting System

FROM the detailed reports of investment in physical property of a New England central station serving a city of about 120,000 inhabitants and surrounding territory are taken the following itemized costs of installing a system of ornamental street lighting including 810 Form 6, 1,000-cp., 6.6-amp. Novalux units, and also 175 6-ft. Cutter mast arms and 230 poles, together with transformers, metering and protective equipment, and the cost of related changes at the generating station.

	No.	Price per Unit	Sub-totals
30-ft. poles	209	$7.39—	$1,544.20
35-ft. poles	60	10.15—	608.85
40-ft. poles	38	14.19—	539.10
45-ft. poles	6	21.50	129.00
4-pin crossarms	248	1.34+	332.95
6-pin crossarms	49	1.89+	92.82
8-pin crossarms	88	2.34—	205.83
Number 6 weatherproof wire, lb.	6,365	0.23+	1,468.38
Number 6 tree wire, ft.	115	0.07—	7.80
Street light fixtures	83	8.37+	694.95
General Electric series sockets	83	0.50	41.50
40-cp., 7.5-amp. lamps	138	0.37—	50.79
Insulators	1,410	0.06+	89.59
60-amp., 3,000-volt oil switch	1	.....	30.71
Anchors	5	2.45	12.25
Pole steps	....	.....	46.39
Trucking	....	.....	283.50
Labor	....	.....	3,173.67
Insurance	....	.....	69.42
Automobile charge	....	.....	227.94
Storeroom charge	....	.....	280.70
Miscellaneous nuts, bolts, washers and small items	....	.....	191.02
Total cost of work			$10,121.36



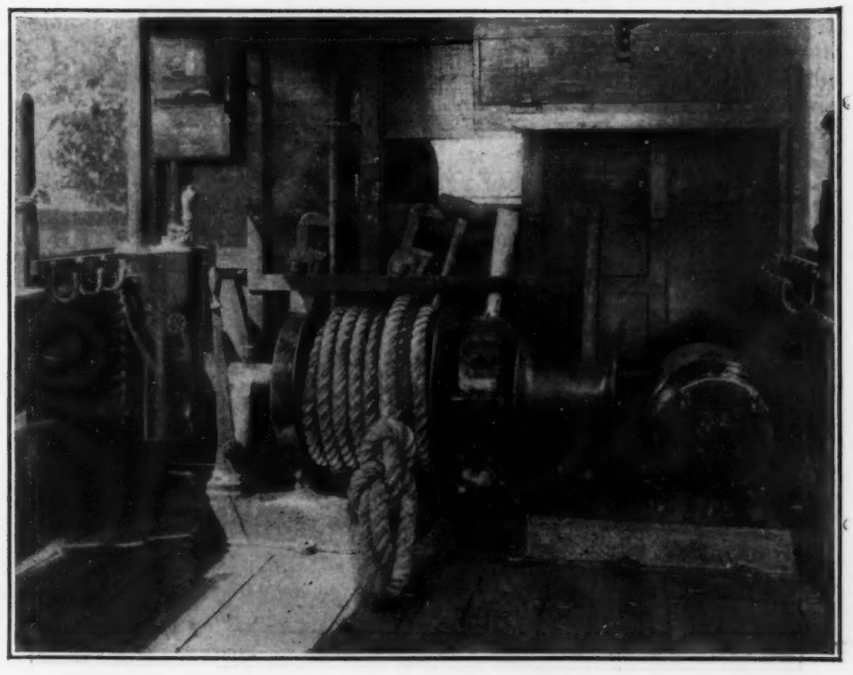
FIVE-TON ELECTRIC TRUCK EQUIPPED WITH THE LATEST TYPE ELECTRICALLY DRIVEN WINCH

Although some of the items are not identified as regards their detailed application to street or station service, a sufficient identification of many is apparent to render these data of interest to engineers as an example of actual field costs in an important branch of public service. The work was completed in October, 1925.

Utility's Truck Equipped with Electric Winch

A FIVE-TON electric truck has been added to the existing electric fleet of the New York Edison Company for general utility work, carrying of central-station material, pulling of cable in underground ducts and general work on the system. It is equipped with an electrically driven winch, operated from the main truck battery. The estimated drawbar pull of this winch is approximately 12,000 lb. It is equipped with an 85-volt, 50-amp., 1,900-r.p.m., series type automotive direct-current motor.

The motor control consists of a forward and reverse type drum switch and a resistor in series with the motor. The resistor has four taps and in conjunction with a controller provides five speeds forward and reverse.



INTERIOR OF TRUCK, SHOWING ELECTRIC WINCH EQUIPMENT IN PLACE

Commercial Activities and Public Relations

Customer Service on Rural Lines

Importance of Personal Relations in Rural Business—Revenue Producing Equipment Kept in Operation

BY E. R. MEACHAM
Director of Rural Service Wisconsin Power & Light Company, Madison, Wis.

FOR improving the quality of its electric service to farmers, the Wisconsin Power & Light Company, through a separate rural service department, has begun a unique form of service work. It is felt in that company that success in rural electrification does not depend entirely upon a uniform and satisfactory financing plan and rate schedule for rural service, nor even upon securing a large number of customers under such a rate. Such a plan and rate have been formulated and more than 1,000 farmers have already accepted the new schedule. In addition the company believes that every reasonable means must be used to make electric service to the farmer so complete, so satisfactory and so convenient that he cannot get along without it.

As the first step in this direction the rural service department is sending out a man with a car along all of the company's farm lines. Without waiting for the farmer to report trouble or ask for help, this service man calls on every customer. He inspects the wiring and switches, examines the motors and appliances and lends a sympathetic ear to all complaints and tales of woe about the service or the company in general.

Whenever this man finds any wiring in a dangerous condition, or any appliance in need of repair, or any motor not functioning properly, he makes the necessary change, repair or adjustment then and there if possible. The customer is not charged for time but only for material used. In this way many inactive appliances that have been set aside because of some minor defect are put back into service at little or no cost to the owner. From the load-building standpoint this is just as valuable to the company as the sale of new appliances, and it is accomplished much more easily and cheaply. To the customer it is like getting a new appliance for one that had been abandoned.

Rural Better Service Report

Line Ithaca Date October 19

No. of Calls Made 10 Equipment Replaced 550 Watts

Contracts Signed (U-3342) { Change-over Customers ___ / New Customers 1

Lamps Sold

Number	3	2								
Size	40	50								
Total Watts	120	100								220

Adjustments Made

Nature of Adjustment	Number
Repaired loose flush switch	1
Repaired broken iron cord	1
Removed broken screw from receptacle and put in new	1
Fastened fixtures to the ceiling	1
Repaired tumbler switch	1
Cleaned badly gummed motor brushes to overcome arcing at commutator	1
Total Adjustments	6

Remarks:—

METHOD OF REPORTING FARM SERVICE

FARM SERVICE CAR IN USE ON LINES OF WISCONSIN POWER & LIGHT COMPANY

For the empty sockets found on every farm the service man carries a supply of lamps, but he does not push their sale. They are simply available as an accommodation to the farmers who may wish to buy. Even on this basis the sales for October averaged about 175 watts per day. During the same month the wattage of the appliances replaced in regular use amounted to almost 300 watts per day.

But the repair and adjustment of the farmers' mental attitude toward the company is more important than the mending of his equipment. This the farm-service man is able to accomplish, going to the bottom of underlying causes of any dissatisfaction. He makes no attempt to whitewash the company and hang the blame on the farmer. Instead he tries to find the facts in each case and to remedy every undesirable condition for which there is no satisfactory explanation. Contact with this representative helps the farmer to get the kind of service he wants and the company wants to give him.

The nature and amount of work accomplished is reported each day. A typical report of this kind is illustrated herewith.

The rural service car used is a light roadster with a special box at the rear for carrying tools and re-

placement materials, ammeter and voltmeter and a supply of lamps. On the sides of this box the words "Electric Service for the Farm" are painted in contrasting color, together with the company emblem. This introduces the service man and advertises the work.

Several factors entered into the selection of Harry N. Gilbert, the man who is inaugurating this work. First of all, he knows electric appliances and equipment. Second, he talks the farmer's language. The elements of personality, which further determine his success in dealing with these men through winning their confidence, are immeasurable factors which count for much.

"This is the first service of the kind that the farmer has ever received," says Dr. E. A. White of the National Committee on the Relation of Electricity to Agriculture. "Plenty of manufacturers have offered to service their own appliances, but they have gone out only at the call of the customer—and most servicing stops at the city limits. Here we have a regular program for the periodic inspection of all the electric equipment that the farmer is putting into use. It is certainly for the good of the service and the industry."

Utility's Radio Entertainment Encored

LIKE other utilities in the United States, the New York Edison Company has extended and cemented its public contacts and friendships through the broadcasting of radio programs of a high caliber devoid of commercial aspects. Its efforts in this respect have been rewarded by the enthusiastic requests for additions to its series of programs.

When the "World Tour in the Realm of Music" series of concerts, rendered weekly by the Edison ensemble through the courtesy of W R N Y, drew to a close, so many requests were received for further concerts of this nature that six additional "tours" were added and a new edition of the "World Tour" was issued under the heading "Further Travels in the Realm of Music."

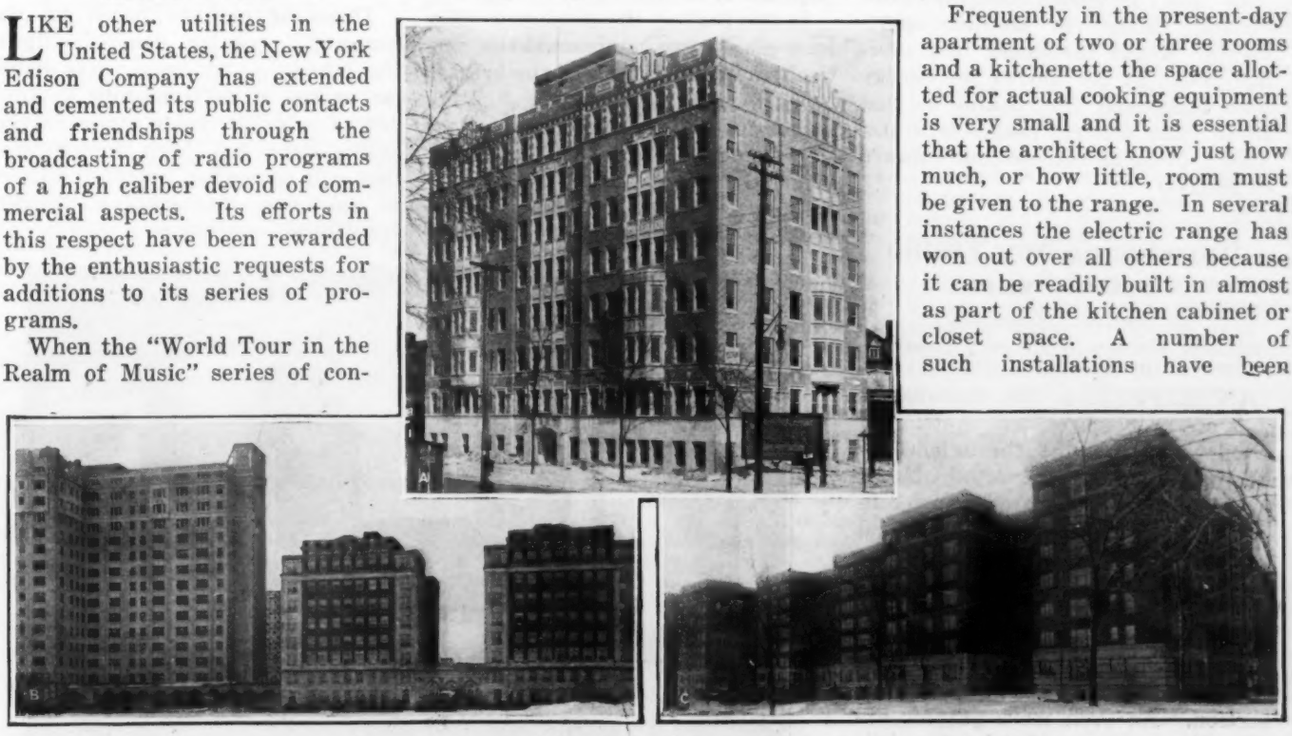
Since that time many additional expressions of appreciation have been received, so a new series of programs has been arranged, with the co-operation of the radio station, by its program director, Dr. Charles C. Isaacson. An exceptionally well-written and interestingly illustrated booklet entitled "Twenty-One Adventurous Nights" has been published, presenting in advance an outline of the theme of twenty-one additional Edison hours.

Range Load Increasing in Detroit Apartments

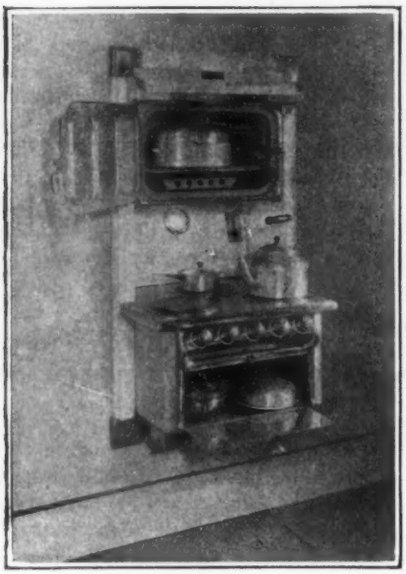
USE of the electric range in apartment-house kitchens, in which space and convenience are of first importance both to landlord and to tenant, is becoming more and more popular. In Detroit especially the placing of electric ranges in the new apartment houses is becoming quite general and the Detroit Edison Company is realizing some very generous increases in the use of energy by domestic customers from this source. In the last year more than a dozen new apartment buildings in that city have been equipped with electric ranges exclusively and a number of others are in prospect.

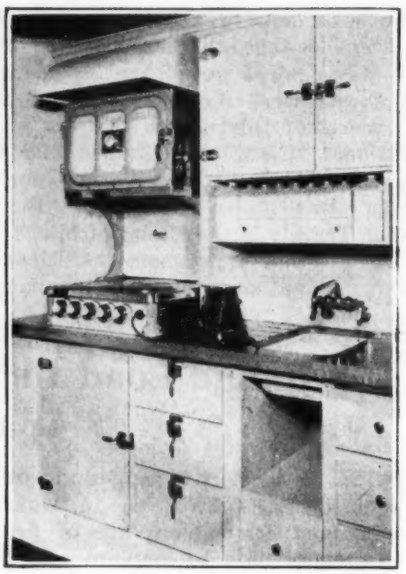
Development of this class of business calls for a considerably different sales approach than that used in selling ranges to individual customers living in detached houses. Plans and specifications for apartment buildings when drawn up by the architect stipulate the kind of equipment to be installed in each apartment, including the kitchen equipment. If an electric range is to be used, the architect so specifies and it is necessary at the same time to provide wiring sufficiently heavy to carry the load. In this connection Fred W. Bagnall of the Standard Electric Stove Company, co-operating with the Detroit Edison Company, has met with much success in effecting the installation of electric ranges in Detroit apartments by maintaining a close contact with architects and obtaining the specification for electric ranges at the time the plans are drawn.

Frequently in the present-day apartment of two or three rooms and a kitchenette the space allotted for actual cooking equipment is very small and it is essential that the architect know just how much, or how little, room must be given to the range. In several instances the electric range has won out over all others because it can be readily built in almost as part of the kitchen cabinet or closet space. A number of such installations have been



THREE DETROIT APARTMENT BUILDINGS EQUIPPED WITH ELECTRIC RANGES
A—Cranbrook Apartments, 28 ranges. B—Whittier Apartments, 218 ranges. C—Indian Village Manor, 96 ranges.





BUILT-IN TYPES OF ELECTRIC RANGES USED IN A NUMBER OF DETROIT APARTMENT BUILDINGS

made in Detroit and the type of equipment used is shown in the accompanying illustrations. One of the large apartment buildings in Detroit, the Whittier Apartments, has been equipped throughout with built-in ranges of the Standard Model 423. Another apartment building, the Cranbrook, having more rooms per apartment than the former, uses a somewhat larger model but also of the built-in type.

During the first ten months of this year Mr. Bagnall installed 1,329 electric ranges in Detroit apartments. Range customers' bills average about $4 per month for energy used exclusively for cooking so that these 1,329 electric ranges will produce a gross annual revenue upward of $60,000.

Introducing New Traffic Control System

BY VICTOR STARZENSKI
Resident Manager Adirondack Power & Light Corporation, Schenectady, N. Y.

ANTICIPATING the installation of a synchronized system of traffic control lights throughout its business district, Schenectady, N. Y., avoided the usual introductory confusion by conducting an educational campaign well in advance of the actual installation.

In the local newspapers was published a series of articles with diagrams showing what effect the system would have on each street intersection. An even more graphic explanation was provided by the Adirondack Power & Light Corporation in its display windows. In the center of one window was placed a model of a street corner with miniature three-light, one-way signals at each intersection. Illuminated arrows in the streets indicated through traffic and the left and right-hand turns.

To the right of the miniature display was placed the master control box, with the front open so that the operation of the mechanism could be observed. A sign explained the purpose of the box and told how adjustments are made for different frequencies of sequence.

In the rear of the display window were placed two commercial-size vertical traffic-light units of the bracket type for attachment to lighting standards. These units, as well as the master control box previously referred to, were manufactured by the General Electric Company. Connections were made between the commercial-size traffic-control units and the minature units, so that the proper traffic movement would be immediately evident by watching the traffic light and the arrows in the street.

UTILITY DISPLAY TO ACQUAINT PUBLIC WITH NEW TRAFFIC SIGNALS

Electric Refrigerators Raise Domestic Consumption 64 per Cent

FROM an analysis of twenty residential accounts the Public Service Company of Colorado finds that the average monthly consumption after the installation of a domestic electric refrigerator has increased 56.7 kw.-hr., or 64 per cent, compared with that before refrigerator use. Simultaneously the average monthly bill increased $4.09, or 59 per cent.

The following tabulation gives the results of the analysis in more detail:

Average monthly kilowatt-hour consumption for twenty customers before installation of electric refrigerators	88.7
Average monthly kilowatt-hour consumption for twenty customers after installation of electric refrigerators	145.4
Average monthly increase in kilowatt-hours after refrigerators were installed	56.7
Average monthly bill before installation	$6.94
Average monthly bill after installation	$11.03
Average monthly increase in bill	$4.09
Percentage of increase in kilowatt-hours with installation	64
Percentage of increase in bill over former bill	59

These figures are based on the company's regular domestic lighting schedule and cover three popular makes of refrigerators in residences only. Recently a new refrigerator rate has been inaugurated that will somewhat benefit the users of the larger machines and heavier residential consumers.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Hydro-Plant at Tiegitsch, Austria.—E. ROSENBERG.—In this hydro-electric station, utilizing a head of 235 m., are installed at present two three-phase, 50-cycle generators of 13,000 kva. each. The two machines were furnished by two manufacturers, the present paper giving details of one of them. Designed for 5,500-volt and 750 r.p.m., the complete generator weighs 85 tons, the eight-pole rotor alone weighing 30 tons. The latter is built up of five massive steel disks, which are held on the shaft by shrink fit. For this purpose each disk was placed over the leg of a special transformer and was heated by eddy losses in the disk itself. Two dovetail feet hold each pole securely to the rotor body. A test with an 80 per cent overspeed had no detrimental results. The pole winding is made of an edge-wound copper bar. To remove all stresses and spring action from this winding each coil, after being wound, was thoroughly annealed, a large amount of current being passed through it for 20 minutes. To simplify transportation, the stator is made in two parts, which join in the horizontal plane. Each slot conductor carries 1,365 amp. and is built up of sixteen parallel conductors. To insure a nearly sine-wave shape, several of the stator slots were left empty. At unity power factor and full load an efficiency of 96.2 per cent was measured at a maximum temperature rise of 47.5 deg. C. on the hottest part.—*Zeitschrift des Vereines Deutscher Ingenieure*, Oct. 23, 1926.

Structural Features of the Steam Turbine Rotor.—J. M. DOWNER.—Progress in turbine design and ratings are discussed in this article. Attention is called to the extreme care necessary in the manufacture of the turbine wheels, and mention is made of magnetic and other types of tests for the discovery of faults normally invisible. Blade materials and methods of fastening are explained, and the subject of testing for balance is handled briefly.—*General Electric Review*, December, 1926.

Transmission, Substations and Distribution

Vincent 220-Kv. Transmission Line.—C. B. CARLSON and H. MICHENER.—This paper deals with the design and construction of the third 220-kv. line between Los Angeles and Big Creek, giving the results and a brief description of the research engineering investigation which was carried out in connection with the design. The line is 223½ miles in length, over a direct route with few angles, and uses dead-ends only at station terminals and very heavy angles. The conductors are of steel-reinforced, 1,033,500-circ.mil. aluminum, with 54 strands and 134,000 circ.mil. steel with seven strands. The towers employed are of high-elastic-limit steel. Single-string suspension insulator assemblies, using thirteen units where a maximum stress in the string will not exceed 6,000 lb., are employed. A double string of thirteen units in length is used where the maximum load will exceed 6,000 lb.—*Journal of the A.I.E.E.*, December, 1926.

Zigzag Transformers.—M. VIDMAR.—Whenever three-phase transformers with isolated neutral are called upon to deliver three decidedly unequal single-phase loads, the so-called zigzag connections offer the most satisfactory solution. This condition occurs very frequently in European practice, and zigzag-connected three-phase transformers are therefore quite common abroad. In spite of the great popularity of this type of lighting transformer, its exact characteristics are not as yet so well known as its application would warrant. The question of voltage drop particularly deserves a closer investigation. This is the purpose of this paper, which goes into great detail to explain, with the aid of vector diagrams, the characteristics of zigzag transformers. The thoroughly practical article shows the best possible arrangements of windings for interleaved disk types and concentric cylinder types of machines, with particular attention to the extent of the stray flux. Parallel operation with other transformers is investigated, and it is shown under which conditions this is possible. On a practical example of a 100-kva. zigzag transformer with certain assumed phase loads the generally discussed features are given in concrete values.—*Elektrotechnik und Maschinenbau*, Oct. 10, 1926.

Generation, Control, Switching and Protection

Selection of Switchboards and Switchgear.—S. W. MAUGER.—The subject of the choice of switching equipment is discussed under a number of divisions and subdivisions. The matter of selection depends upon the application being considered, although there are certain general rules which apply to all installations. These the author sums up as follows: (1) An equipment should be selected on the basis of lowest price consistent with serviceability measured in terms of ability to meet conditions, durability, accessibility, safety and appearance. (2) Proof either by previous performance or by test should be required to show that the apparatus will have the necessary measure of serviceability. In addition to discussing these points, the author takes up the conditions which are to be met at different operating voltages.—*General Electric Review*, December, 1926.

Transformer Radiator Valve.—E. L. R. BLISS.—The author discusses the conditions which make necessary the shipment of transformers oil-filled and the need for radiator valves for these conditions and follows this by a discussion of the construction of the valve with an enumeration of the advantages to be derived from its addition to the equipment. The transformer radiator valve is of the modified butterfly type built directly into a standard radiator flange, and therefore requires no additional valve body, no additional gasket joint, and takes up no more space than the flange itself. During shipment the valve is protected by an extension of the shipping plate to prevent the valve being opened during transportation. Unlike the outlet plugs which have been used for this purpose, the usefulness of the valves does not end at the time the unit is installed, according to the author, but is available for any subsequent occasion when a radiator is to be removed or replaced.—*General Electric Review*, December, 1926.

Units, Measurements and Instruments

Mechanical Tests of Insulating Materials.—O. GRUNWALD.—Specifications of the V.D.E. prescribe a certain minimum of mechanical strength for parts made or molded of insulating compounds, such as caps for snap switches. The hitherto employed simple means of testing such pieces with a sort of calibrated pliers, exerting a pressure of 10 kg. at the edge of the cap, did not prove fully satisfactory. The author outlines a new testing tool, acting on the pendulum impact method, which, it is claimed, not only gives more reliable data but subjects the test pieces to stresses more nearly comparable to the actual strain to which these parts are subjected in their every-day use. Test data, obtained with these new implements, are given.—*Elektrotechnische Zeitschrift*, Nov. 4, 1926.

Illumination

Recent Developments in Lamp Life-Testing Equipment and Methods.—J. F. SKOGLAND and R. P. THELE, JR.—The candlepower scale of a horizontal photometer, with test and comparison lamps at a fixed distance apart, is a slide-rule scale to within the limits of photometric observational error. In conjunction with such a candlepower scale other scales have been arranged to compute required values of lumens per watt, percentage light output and percentage of efficiency. Vacuum tungsten lamps have a constant ratio of total light output to the value of mean horizontal candlepower. To adapt the horizontal photometer to measure lumens per watt directly as required by the revised specifications for incandescent lamps, it was necessary to add to the equipment scales computed on the basis of the known reduction factors for each size of lamp. Other life-test requirements are that a mean light output and mean efficiency during life be readily determined. Scales from which these values are read directly in percentage of the initial values have also been added to the equipment. Simplified methods of integrating the light output and efficiency curves of lamps derived as a result of the photometric measurements during life have been devised. The method does not require the actual construction of percentage efficiency and percentage output curves and reduces the computation to simple addition.—*Bulletin No. 325, United States Bureau of Standards.*

Electrophysics, Electrochemistry and Batteries

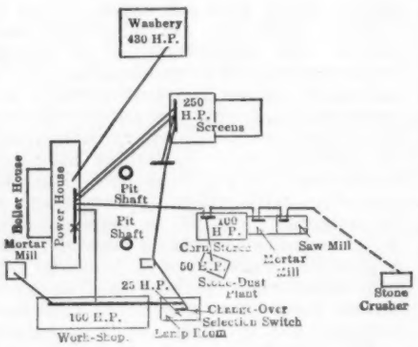
Passivity and Corrosion of Iron.—LEON MCCULLOCH.—Two new instances of passivity in iron are described in this paper. In a solution of ammonia and ammonium chloride, iron was found either to be corroded rapidly or else to be passive. An addition is attempted to the current theory of the corrosion of iron. The progressive rusting of iron is ascribed to the "catalytic" action of soluble iron salts, which are held upon the iron surface by the coating of rust. These soluble iron salts are a product of the electrolytic action which takes place over the surface of a metal when exposed to natural waters and air. Thus, according to the author, the modern electrolytic theory and the old acid theory are combined into one, but the carbon dioxide to which the corrosion was attributed by the old acid theory is no longer necessary, since iron salts of stronger acids are seen to be present.—*American Electrochemical Society*, Oct. 11, 1926.

Electrolytic Oxidation of Para-Bromotoluene and Ortho-Nitrotoluene.—J. F. CONN and ALEXANDER LOWY.—Para-bromotoluene and ortho-nitrotoluene were subjected to electrolytic oxidation in dilute nitric-acid solution of such a concentration as would bring about only slight chemical oxidation. Parad-bromotoluene was converted to para-bromobenzoic acid with excellent yields. The favorable conditions are: (a) an electrolyte of 20 per cent nitric acid, (b) platinum electrode, (c) vigorous stirring, (d) a current density of 0.50 amp. per square centimeter, and (e) temperature of 100 deg. C. Ortho-nitrotoluene was converted to ortho-nitrobenzoic acid in low yields. A resinous material, oxalic acid and carbon dioxide were the other products formed on oxidation. No solvents were used.—*Paper presented before the American Electrochemical Society at Washington*, October, 1926.

Motors and Control

Circle Diagrams of the Three-Phase Shunt Commutator Motor.—A. H. M. ARNOLD.—A simplified mathematical theory of the circle diagrams of the three-phase shunt commutator motor is developed from the theory of the standard polyphase induction motor. Sources of error in the theory are outlined, and the theoretical circles are then compared with test-results. Formulas are developed for the slip, torque and mechanical power. The improvement in performance of the motor which may be obtained by an unsymmetrical setting of the brushes is described fully, and an approximate formula for the circle diagrams under these conditions is given.—*Journal of Institution of Electrical Engineers* (*England*), November, 1926.

Colliery Electrification.—G. S. BOWDEN.—The example taken for these notes is a large colliery employing 2,500 men and consuming 4,000 kw. at peak loads. The winding is done by modified Corliss cross-compound steam engines, and electricity is generated by mixed-pressure steam turbo-alternators, each of 3,000 kw. capacity. Various collieries, each of like capacity, are linked by overhead transmission lines operating at 11,000 volts. The choice of generating pressure is decided by the relation between the amount of power generated locally and that used on the side. The choice of main switchgear is the next point considered by the author. At the time when the particular power station being discussed was laid down originally, ironclad draw-out or truck-type switchgear had not developed to the extent that it has at the present day. Switchgear maintenance and repairs in most colliery districts are carried out by men who are not of the experienced and capable type which is attracted to the large power stations. Air in the neighborhood of a colliery is necessarily dirty and sometimes full of fumes from coke ovens and byproduct plants. Bright work and bare metal become corroded and high-voltage switchboards need cleaning every three months. Safety dictates the use of foolproof switchgear, and where cleaning costs have to be kept down, the totally inclosed ironclad



DISPOSITION OF COLLIERY ELECTRICAL LOAD

draw-out type is necessary. Colliery power factor is notoriously bad, according to the author, and ranges from 0.6 to 0.8 lagging. Synchronous induction motors are being used as means for increasing the total power factor. Oil switches of large breaking capacity cannot be accommodated underground, ordinarily, and the only alternative is to reduce the severity of possible faults. Reactances can be used to attain this end, together with suitably arranged feeder circuits. The author proceeds in detail to discuss these applications.—*Electrical Review* (*England*), Nov. 26, 1926.

Traction

Electrification of the Spanish Northern Railway Reduces Operating Costs.—W. D. BEARCE.—A report recently issued by the management of the Spanish Northern Railway Company discloses unusually complete data on the results obtained by the electrification of the Pajares grade of this system. After describing and illustrating the electrical equipment, traffic considerations and physical characteristics of the division, the report concludes with a chapter of statistics, which were abstracted by the author of this article from the original Spanish text.—*General Electric Review*, December, 1926.

Telegraphy, Telephony, Radio and Signals

Carrier-Current Communication Over Transmission Lines.—E. F. CARTER.—The author discusses the requirements to be fulfilled for this service, describes the single-frequency duplex equipment and takes up the subject of intersystem communication. The outstanding requirements as enumerated by the author for this type of service are: (1) The equipment should utilize the minimum number of carrier frequencies for its operation either on a single power system or on a group of systems. (2) The station equipment should be so built that it can either initially or by the addition of equipment after installation provide intersystem communication; that is, communication between the systems of two or more power companies. (3) The equipment should have a high factor of safety against failure, because of the dependence placed upon it for emergency communication. (4) A selective calling system should be included in order that calls to one station may not disturb other stations. (5) The available equipments should include a light portable transmitter and receiver unit which can be carried by a patrolman and which can operate with the primary equipments. (6) The transmitter must be capable of putting sufficient energy into the line to make extreme amplification unnecessary at the receiving end. (7) The transmitter equipment should have a reserve capacity automatically available for operation under abnormal line conditions. (8) The equipment must lend itself to wire-line extension, such as from an office building situated at a distance from the carrier set itself. (9) The available carrier apparatus should include a set of lower cost than the primary station equipment, such a set being designed for secondary stations where communication is only occasionally required. (10) The equipment must include a sufficient number of indicating meters to give a clear indication of normal functioning. (11) The equipment should be flexible enough to operate satisfactorily with the type of coupling best suited to the local conditions. (12) The equipment must be capable of being installed at an appreciable distance from the transmission line, when the system layout makes this imperative. (13) Equipment must be available for bypassing gaps in the carrier circuit such as open power switches and frequency changers. (14) Provision must be made to insure communication for a reasonable period of time during interrupted alternating-current station service. (15) The equipment should be capable of being operated from a remote station, using for this purpose circuits or wires erected on transmission-line towers and subject to inductive interference from these power circuits. (16) When carrier installations are made on a given system with the distance between stations varying widely the equipment should be able to maintain automatically a constant received signal strength at all stations, regardless of the distance to the transmitting station.—*General Electric Review*, December, 1926.

News of the Industry

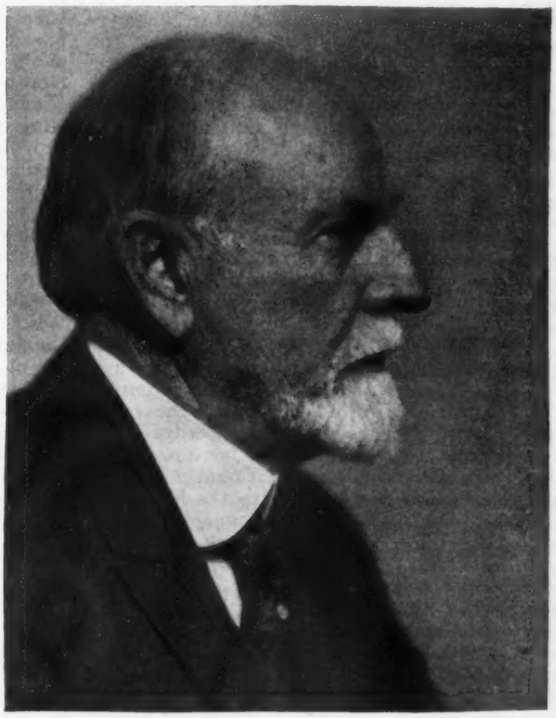
Tribute to James H. McGraw

Engineers, Industrialists, Educators, Business Associates and Other Friends Unite to Recognize His Work for Technical and Business Journalism

A NOTABLE tribute to James H. McGraw as a publisher, a leader of industry and a man was paid on Friday evening, Dec. 17, when a thousand representatives of engineering, industrial, educational, publishing and other callings filled the banquet room of the Hotel Astor, New York, to take part in a dinner in his honor. The immediate occasion was Mr. McGraw's sixty-sixth birthday anniversary, which coincided with the completion of more than forty-one years in the field of industrial and technical publishing. In this period the McGraw-Hill Publishing Company, Inc., of which he is president, has grown from small beginnings to its present magnitude.

John W. Lieb, vice-president New York Edison Company, was toastmaster, and at the speakers' table, besides the guest of honor, were Arthur Williams, chairman of the dinner committee; Charles L. Edgar, Thomas E. Murray, Walter R. Addicks, Gerard Swope, M. S. Sloan, W. W. Freeman, E. M. Herr, Frank W. Smith, Willits H. Sawyer, Edward J. Mehren, Dexter S. Kimball, Guy E. Tripp, Philip G. Gossler, Martin J. Insull, William L. Saunders, Judge William L. Ransom, H. M. Edwards, Robert Ridgway, George S. Davison, E. H. Rosenquest, Calvin W. Rice, Fred R. Low, John V. W. Reynders, A. L. Salt, Philip Torchio, J. Waldo Smith, George F. Kunz, C. Stanley Mitchell and Newcomb Carlton.

Mr. Williams read a telegram from Thomas A. Edison, honorary chairman of the committee, expressing regret at his inability to be present, and similar telegrams from Judge E. H. Gary, Secretary Hoover, Secretary of War Davis, Owen D. Young, John Hays Hammond, General Benedict Crowell and others.



JAMES H. MCGRAW

REPRESENTATIVE SPEAKERS

Mr. Lieb, before calling on the speakers chosen to represent various business and professional interests, sketched Mr. McGraw's career briefly, dwelling for a minute on the comprehensive nature of the McGraw-Hill publications, which, he pointed out, were not confined to the electrical field but covered nearly all branches of engineering and the general interests of industry.

Willits H. Sawyer, president of the American Electric Railway Association, told what Mr. McGraw's counsel and leadership had meant to the electric railway industry, recalling that the publisher's first venture had been with the old *Street Railway Journal* of 40 years ago. This industry, he said, in spite of temporary adversity, must and will go forward. The McGraw-Hill papers had pointed the road to constructive co-operation instead of destructive competition with the bus industry. He called the guest of the evening a "fountain of well-directed enthusiasm" and read a testimonial to him on behalf of the railway association.

General Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, who was called on to represent the manufacturing interests, refused, in a witty speech, to "catalog" Mr. McGraw, but referred to him as a "practical philosopher" and said that idealism was one of the foundation stones on which the publisher had built. General Tripp suggested that engineers were not tolerant enough of the imaginative and romantic element in their calling. Had they grasped more fully the opportunities to interest the public in this aspect of their work, he thought that Governor Pinchot's visualization of "giant power" and Professor Ripley's attack on holding companies might have lost much of their popular appeal, for the public would have had a sounder conception of superpower and would understand that the holding company is the only feasible instrument by which its advantages can be realized. The speaker suggested in a semi-humorous vein that Mr. McGraw start a new publication devoted to the sociology of business.

Speaking for the light and power industry, Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, dwelt on the relation between journalism and the industry. He praised the ELECTRICAL WORLD for its unbiased and open-minded attitude toward all electric light and power problems, saying that a periodical devoted to destructive criticism or a merely lukewarm paper would have injured or left uninfluenced an industry which the ELECTRICAL WORLD by its constructive policy had done much to build up. Mr. McGraw, the speaker said, had the faculty of making the busy leaders of the electric light and power industry contribute in their turn to the papers he publishes, drawing from these leaders their best thought. He was an outstanding example of the spirit of co-operation.

A scholarly address was contributed by Dean Dexter S. Kimball of the College of Engineering at Cornell University, speaking for engineers. Emphasizing the superior endurance of the written word as compared with that merely spoken, he associated Mr. McGraw and the publications of his company with the spirit of engineering and science. For the first time in the world's history, Dean Kimball said, hope of universal well-being is held out to a great nation. The problems of production had been solved in the main; those of distribution were not yet entirely worked out. In their solution and in the promotion of engineering knowledge, for which the people were now eager, and the development of the economic side of industry, the publications of Mr. McGraw were taking a noteworthy part.

Edward J. Mehren, vice-president McGraw-Hill Publishing Company, spoke for Mr. McGraw's associates in business, dwelling on the principles that the publisher had set up to govern his technical, trade and industrial papers. These papers, he said, Mr. McGraw desired to be collectors and distributors of information, interpreters of events and trends in their respective industries and promoters of sound thought

DAIS AND PART OF THE HUNDRED TABLES FILLED AT THE COMPLIMENTARY DINN

and policy. Mr. McGraw, imbued with an intense spirit of service, possessed faith illumined by vision, courage and perseverance. He insisted on a superior product, minute specialization, intimate contact with leaders in the field and intense application characterized by hard work and sacrifice. Mr. McGraw's criticism, the speaker said, was always constructive. McGraw believed journalism to be the calling of the youthful, not necessarily in years, but in spirit, and his own bent of mind was well shown by his admiration for Abraham Lincoln, pictures of whom adorned his home and his office.

All the speakers paid personal tributes to the guest of the evening, in which the toastmaster joined. Mr. Mehren in this connection described the close relations existing between Mr. McGraw and his staff and the bonds uniting the McGraw-Hill company in common endeavor under his leadership.

MR. MCGRAW'S RESPONSE

Responding, Mr. McGraw attributed any accomplishment of his to two things—capable and loyal associates and the support of the professions and industries represented at the dinner. He expressed in warm terms his gratitude to the engineers and industrialists of America and asked their continued co-operation. When he had fought, the publisher said, he had done so without passion. His sole objective was accomplishment, and when an object was attained there was no room for bitterness or jealousy over the apportionment of credit. Optimism, Mr. McGraw observed, was an essential of leadership. There must be faith that sincere and earnest work will be rewarded. Edited in this spirit, industrial papers would not only be human but vibrant with life and imbued with the ambition of high service. In his more than forty-one years of work the publisher had seen the civilized world made over. He rejoiced in the engineers and industrialists and the marvels they had wrought. Three score and six years, he declared in conclusion, had no terrors for him. It was no time to retire but to press on to further endeavor, repaid by the fascination of work—the "joy of the job."

Year's Growth of Pacific Gas & Electric

Nineteen Million Dollars Expended in 1926 in Work on Dams, Power Houses, Substations, Transmission Lines and Auxiliary Equipment

GLANCING back at the achievements of the year just closing, the Pacific Gas & Electric Company records briefly what was done to meet the ever-increasing demand for more electrical energy in northern California. The company has "built dams to store mountain waters, increased the capacity of generating plants, started new power projects, strung new transmission lines, reared the world's tallest transmission tower, erected substations and added costly electrical equipment. By New Year's Day the lump sum for such construction and improvement will reach $19,000,000."

One of the big jobs of the year, says *P. G. and E. Progress*, was the completion of the work of raising the rock-restraining wall of Lake Fordyce, the great storage reservoir far up in the mountains of Nevada County. Forty-seven feet were added to the height of the dam, increasing the capacity of the lake from 20,000 acre-feet to 46,700 acre-feet. The job cost $1,650,000. Another dam, 80 ft. high, designed to provide more water for the De Sabla and Centerville power houses, was built across Philbrook Creek in less than six months at a cost of $255,000.

The dam for Pit No. 4, next link in the company chain of Pit River power developments, was started and is now well under way. With five months of construction still to come, the total cost is estimated at $1,740,000.

Work was begun on two big projects. One calls for the building of a power plant at Melones, to cost $2,500,000, which will draw its water supply from the dam built by the Oakdale and South San Joaquin irrigation districts. The other and larger—the Mokelumne project—includes a dam at Salt Creek, a 47,000-hp. generating plant on Tiger Creek, and revamping and enlargement of the Electra power plant.

Two new substations—J and L—were built in San Francisco and were equipped, one costing $308,000 and one $250,000. Additions at the new Martin substation, terminal of all the hydro power transmitted up San Francisco peninsula from the big substation at Newark, cost $721,000. More than a quarter of a million was spent in doubling the capacity of Substation I, which provides commercial service for a busy district "south of Market Street." At Station A, the big steam-electric generating plant in the Potrero, many improvements and additions were necessary to take care of increased demands. That work required an expenditure of $300,000.

In the East Bay division the new substations I and E in Oakland were completed at a total aggregate cost of $766,000. Reconstruction of Substation H in East Oakland took $260,000 more. Then there were two other new substations built in Oakland, L, on which $733,000 was spent, and D, the bills for which totaled $575,000. The Contra Costa substation, near Antioch, was completed and is now receiving Pit River power transmitted from the Vaca-Dixon terminal over a newly constructed line. The cost was $600,000. In the North Bay division $230,000 was spent on rehabilitating substations and providing facilities for additional service. San Jose saw rapid progress made on the building of a new substation that will cost $584,000. The Manteca substation in San Joaquin division was reconstructed at a cost of $307,000. Quick work was done in supplying energy for the plant of the Calaveras Cement Company near San Andreas. Company builders began the foundation for the substation on March 1; on May 7 it provided power for the cement plant.

In the Shasta division the new substation near Cottonwood, which takes power at 220,000 volts from the Pit River-Vaca-Dixon lines and ties in with the California-Oregon Power Company system at 110,000 volts, was put into operation. The total cost was $524,000.

Thirty-five miles of transmission line were strung from Vaca-Dixon to the

DINNER TO JAMES H. McGRAW, PRESIDENT McGRAW-HILL PUBLISHING COMPANY

new Contra Costa substation. This line runs through the island country north of Antioch. There the cables are supported by exceptionally high towers, one of them at the Sacramento River crossing rising 459 ft., which, the company asserts, makes it the world's highest transmission tower. Cost of the line fell just a little short of a million dollars.

Then there were the Newark-Alviso line, $216,000; the Manteca-Salinas line, $424,000; rebuilding of East Bay distribution lines, $115,000; Novato-Olema line, $125,000; rerouting of lines around Sacramento, $135,000, and reconstruction of lines between Colgate and Smartville, now in progress, $126,000.

New York Electrical League Erects Christmas Tree

Carrying out its annual Christmas tree ceremony, the New York Electrical League on Wednesday, Dec. 22, erected in Times Square a living Christmas tree, which is to be planted in Riverside Drive as a gift to the city. This tree is a great Colorado spruce, a sister to the national Christmas tree installed two years ago at the White House and which will again be lighted this year by the President. The New York league tree was presented by the Amawalk Nurseries, with its roots curled and wrapped, and installed over a subway grating, where it was protected by the warm air. At the base of the tree were electric signs bearing a greeting from the league "to all New York and the stranger within her gates."

Ceremonies at the tree included music by the Gloria Trumpeters, dedication of the tree by President S. E. Kimball of the league and acceptance for the city by Park Commissioner Gallatin, with an appreciation by Louis Wiley of the New York *Times*, speaking for the press. Music from the luncheon in the Hotel Astor was broadcast from the boughs of the tree. More than twelve hundred members and guests were present at the luncheon, where Cardinal Hayes of New York made a Christmas address to the assembled diners.

New York Utility Problems

Governor Advocates Changes in New Commission Law—St. Lawrence Situation Still Debated

REFERRING to the Public Service Commission and Transit Commission of New York State, which under the new state departments law are set up as two divisions of the public service body, Governor Smith said a few days ago in a letter to Walter W. Westall, chairman of the State Reorganization Commission, which is at work redrafting present statutes to conform with the reorganized scheme of government:

"I believe that the structure for the Department of Public Service set up by the state departments law is unconstitutional, unwise and wholly contrary to sound administrative practice. Under the present law the department consists of two practically independent divisions, but in order to have a nominal head of the department so as to conform to the letter of the constitution, it is provided that the chairman of one of the divisions shall for purposes of controlling appointments and salaries be the head of the department. This is no real department head, and the arrangement only lead to friction and trouble within a department whose real functions are regulative and judicial. There should be one Public Service Commission at the head of the Department of Public Service, and this Public Service Commission should be in charge of all of the functions given to the state division and to the metropolitan division in the present law. The chairman of the Public Service Commission should carry out the administrative policies determined by the commission."

Some perplexity is said to exist at Albany as to just what the Governor means by his comments on the Water Power and Control Commission, and it is contended that they seem to hint at further constitutional amendment: "This commission," he says, "is really a combination of the heads of three departments. Its functions apparently require group judgment in the first instance, are primarily quasi-judicial, and since the approval of the Governor is required for all important acts, it would be unnecessary to make the action of this commission subject to the approval of the head of the Conservation Department." The Governor concludes his remarks on this subject by saying: "If my recommendation to establish a Power Authority is adopted, the water-power and water-control functions should be lifted out of the state administration entirely, like the Port Authority."

Opponents of Governor Smith are questioning the right of the Legislature, under the recent constitutional amendment consolidating the state departments, to create such an agency as the Power Authority. They hold it would be a state department not provided for in the constitution. The Governor's legal advisers take no stock in this argument, holding that the Power Authority would be merely a branch of the Conservation Department, as the Water Power Commission is today.

Radio Voice Opens Lighting System in St. Louis

A demonstration of the remarkable flexibility of radio waves carrying sound impulses for the remote control of mechanism was made in St. Louis Dec. 16 at the opening of the new street-lighting system. In the demonstration the voice of Mayor Victor J. Miller, who was speaking at the formal ceremonies attendant upon the opening of the street-lighting installation, was sent to Station KDKA of the Westinghouse Electric & Manufacturing Company in East Pittsburgh, Pa. At KDKA his voice released the impulse from the station's powerful short-wave transmitting equipment which was received in St. Louis. There it actuated relays that threw into operation the mechanism lighting the street system of St. Louis. It was said to be the first time in history that radio waves had been used for the opening of a street-lighting system. Special receiving equipment in St. Louis was arranged so as to actuate extremely sensitive relays. These in turn threw into operation the substation controlling the street-lighting system.

This section of St. Louis' new street-lighting system contains 3,579 lamps,

covering the district between Compton Avenue and the Mississippi River and Chouteau Avenue and Arsenal Street. These lamps are controlled by a clock installed at Thirteenth Street and Ann Avenue. The dedication of the system was preceded by a parade of city officials and members of the various civic organizations in the district included in the area which is benefited by the new standards.

The lighting system which was opened is the first part of an eight-million-dollar project. Approximately 1,000 miles of streets in St. Louis are to be equipped with modern lighting equipment, making the system one of the finest yet installed in any city. Contract for the installation of the second section has been let, covering 3,200 standards with Westinghouse lamps and equipment, as in the section just completed. The contract price is $558,-197. The finished section cost $1,-625,000.

Gherardi to Head Institute

National Nominating Committee Names Vice-President of American Telephone & Telegraph

FOR the offices in the American Institute of Electrical Engineers falling vacant on Aug. 1, 1927, the national nominating committee has selected the following official ticket of candidates:

For president: Bancroft Gherardi, vice-president and chief engineer American Telephone & Telegraph Company, New York.

For vice-presidents: Middle Eastern District—J. L. Beaver, associate professor of electrical engineering, Lehigh University, Bethlehem, Pa.; Southern District—C. O. Bickelhaupt, vice-president Southern Bell Telephone & Telegraph Company, Atlanta; North Central District—O. J. Ferguson, dean College of Engineering and professor of electrical engineering, University of Nebraska, Lincoln; Pacific District—E. R. Northmore, superintendent of electric distribution, Los Angeles Gas & Electric Corporation, Los Angeles; Canada District—A. B. Cooper, general manager Ferranti Electric Limited, Toronto.

For managers: F. C. Hanker, manager central-station engineering, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; H. P. Liversidge, vice-president and general manager Philadelphia Electric Company, Philadelphia; E. B. Meyer, chief engineer Public Service Production Company, Newark, N. J.

For treasurer: George A. Hamilton, electrical engineer (retired), Elizabeth, N. J.

These official candidates, together with any independent nominees that may be proposed later in the manner specified by the constitution and by-laws, will be voted upon by the membership at the coming election in the spring of 1927.

Bancroft Gherardi was born in San Francisco, April 6, 1873. He was graduated with the degree of B.S. from the Polytechnic Institute of Brooklyn in 1891 and from Cornell University with the degree of M.E. in 1893 and degree of M.M.E. in 1894. Mr. Gherardi

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BANCROFT GHERARDI

entered the employ of the New York Telephone Company in 1895 and in 1899 was made traffic engineer of that company. In 1901 he became chief engineer of the New York & New Jersey Telephone Company, serving in that capacity until 1906, when he was made assistant chief engineer of the New York Telephone Company and New York & New Jersey Telephone Company. In 1907 he was appointed equipment engineer of the American Telephone & Telegraph Company and in 1909 engineer of plant, in which capacity he served until 1918, when he was appointed acting chief engineer and shortly thereafter chief engineer. In April, 1920, he became vice-president and chief engineer of the American Telephone & Telegraph Company.

Mr. Gherardi's activities with the American Institute of Electrical Engineers are as follows: Associate, 1895; fellow, 1912; manager, 1905-1908 and 1914-1916; vice-president, 1908-1910. He has served upon various committees, including the Edison medal, telephony and telegraphy, papers, finance, membership, organization of technical committees, constitutional revision and research. He represents the Institute on the United States National Committee of the International Electrotechnical Commission. At the present time Mr. Gherardi is a vice-president and chairman of the finance committee of the United Engineering Society and a member of the Engineering Foundation. He is also a member of the American Society of Mechanical Engineers, the New York Electrical Society and the Franklin Institute.

Controversy Over Federal Power Board

Congressmen Now Finding Fault with Its Political Make-up, Which Is Held to Influence Its Decisions—Muscle Shoals and the Slemp Bid—Broad Powers Asked

BY PAUL WOOTON
Washington Correspondent ELECTRICAL WORLD

KEEN disappointment is in evidence on Capitol Hill because of the unwillingness of the Federal Power Commission to act on any except non-controverted cases. When the water-power bill, after ten years of effort, was passed in 1920 the prevailing sentiment in Congress was that an unusually good job had been done. There is a growing feeling, however, that a commission composed of Cabinet officers is too political. Instead of acting along the lines dictated by sound engineering and economics, the members of the commission are thought to be more responsive to the possible political results of their action. Congress passed the water-power act with the idea that it was to be used. Some of those connected with that branch of government are wondering if it would not be well to vest responsibility with officials who are not such prominent figures in politics.

The sentiment in Congress never was so strong against government ownership as it is now. It is willing to interfere with private initiative only when it clearly is the interest of the majority and when it is necessary to protect the taxpayer. This has given rise to the thought that the federal taxpayer should be relieved of a portion, at least, of expenses where the chief benefit is local. One way which has been suggested would be to require those to whom power rights are given to do the work necessary to navigation, flood control and irrigation. While the federal taxpayer is saved at the expense of the local power consumer, the argument is that the price of power is fixed by other factors than the cost of operation at some one large hydro-electric development. For instance, New England could not complain if the government were to require those obtaining power rights on a stream to provide the navigation channel, as other sources of power are available to New England.

On the Tennessee there is little support for the proposal that the government build the dams on the upper river and its tributaries when it is known that private capital is ready and anxious to build the dams for power purposes, thereby producing the result desired by the government in regularizing the flow.

As a result of yielding to political pressure, the development is being delayed in the entire basin of the Colorado and on the Tennessee and its tributaries. For political reasons no action is being taken at Cumberland Falls in Kentucky. Prompt action was taken on the Nevada Irrigation District's license because of political pressure. Other instances could be cited. Thus by vesting the immediate authority to act in the hands of political leaders some members of Congress feel that the intent of the lawmakers

is being perverted by executive officials who have neither the time nor the courage to administer such an act.

Analysis of New Bid for Shoals

An analysis of the so-called Slemp offer for Muscle Shoals, one which bids fair to remove it from any consideration by Congress, has been laid before the Senate by Senator Deneen of Illinois. The report on the offer was made by Colonel Max Tyler of the Corps of Engineers. Judging from what Colonel Tyler says, no such broad powers as those asked have been granted to a private corporation since the days of the Hudson Bay Company. Many weaknesses in the Slemp proposal are pointed out.

During the past week conferences have been in progress among leaders on the House side of the Capitol, but the decision is said to have been reached that no action shall be taken until the Senate has had an opportunity to discuss the matter. There are reports that the Union Carbide Company may join with the American Cyanamid Company in tendering a revision of the offer of the Cyanamid Company submitted at the last session of Congress.

F. M. Feiker Leaves S.E.D.

Will Become Managing Director of the Associated Business Papers, Inc., on First of Year

FREDERICK M. FEIKER, who has been an operating vice-president of the Society for Electrical Development for more than three years, is leaving that organization to accept an appointment as managing director of the Associated Business Papers, Inc., where his coming on Jan. 1 will mark the inauguration of a more active policy and a broader program in the promotion and development of higher standards of journalism for the business press.

Mr. Feiker brings to the Associated Business Papers a background of experience singularly fitting him for the work he is to do—embracing fifteen years as editor and publisher, a year and a half in the United States Department of Commerce, three years in trade association leadership and a practical experience in educational work. He was born in Northampton, Mass., in 1881 and was graduated as an electrical engineer from Worcester Polytechnic Institute in 1904. In 1915 he joined the McGraw (now McGraw-Hill) Publishing Company as editor of the ELECTRICAL WORLD. Here he guided the early development of *Electrical Merchandising*, becoming eventually vice-president and editorial director of the McGraw-Hill company.

In 1921 Herbert Hoover invited Mr. Feiker to join him in Washington as assistant to the Secretary of Commerce, to aid him in carrying out plans for the reorganization of the Department of Commerce in its relations with trade and industry, and Mr. Feiker thereafter spent eighteen months in government work. During that period he established the Division of Simplified Practice in the Bureau of Standards, revamped the Bureau of Foreign and Domestic Commerce on the basis of service to commodities, assisted in the organization of the monthly survey of business statistics in the Bureau of Census and remade the department's publication, *Commerce Reports*, besides acting as adviser on personnel for the department as a whole. During this period also, in co-operation with A. C. Pearson, who is now chairman of the board of directors of the United Publishers' Corporation, and Edward J. Mehren, vice-president of the McGraw-Hill Publishing Company, he arranged the monthly meetings of the National Conference of Business Paper Editors with Mr. Hoover in Washington. These have continued ever since, and out of them has grown a continuous close contact between the government bureaus, the United States Chamber of Commerce and the business press.

FREDERICK M. FEIKER

Hoover Likes New England Interstate Plan

A comprehensive indorsement of the principle of state regulation of interstate power transmission rather than regulation by the federal government was given by Herbert Hoover, Secretary of Commerce, to the New England Council at a meeting in Providence on Friday of last week, when many problems of economic interest to the six Northeastern states were considered. Affirming his faith in the future of New England, Mr. Hoover declared that in his opinion her major prosperity will lie in the development of specialty manufacturing rather than in mass production, in the enlargement of individual rather than state initiative and in the discouragement of federal encroachments upon the power of the states to conduct their affairs. Unless the tendency toward increasing the power of the federal government over state activities is halted, the Secretary said, disaster and even the breakdown of our system of government are to be feared.

The plan of the New England Council for joint voluntary regulation by state commissions of interstate power contracts, recently reported in the ELECTRICAL WORLD, appealed to Mr. Hoover as offering a possible national solution of the problem. For the power committee of the New England Council, Chairman E. O. Goss of Waterbury, Conn., said that there is now a general movement in the utility industry in New England in favor of adopting suitable clauses to this end in future contracts. All the light and power companies represented in the council are understood to favor the plan, and it is understood that agreements for such regulation passed by the states and approved by Congress will have the necessary legislative standing to prevent extension of federal powers into this field.

Indiana Commission Decides to Hear Merger Petition

After more than three hours' argument on Dec. 16 on whether the Indiana Public Service Commission has jurisdiction to hear the petition for merger of the two Indianapolis light and power companies, supplemented by a talk from Attorney-General Arthur L. Gilliom, the commission decided that it has the right to hear the petition on its merits. Attorneys for the objectors said they will oppose any attempt for an early hearing because they already have expressed a desire to make a valuation of the two properties. The Indianapolis Power & Light Company is, as already reported, seeking authority to issue $55,000,000 in securities with which to purchase the properties of the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company. A property valuation would probably require several months.

Charges by the Attorney-General that the two Indianapolis companies are violating the law by granting secret rebates to the extent of $500,000 a year are to be investigated by the commission. The president of the City Council has declared for a municipal plant and says that a site is available on the Eel River near Greencastle, where he says 10,000 acres of water can be dammed up and power transmitted 35 miles to Indianapolis.

Indeterminate Franchises and Illinois Municipalities

The Illinois terminable permit commission, authorized by the State Legislature in 1925, whose bill was defeated, reconvened in Springfield, Ill., recently to prepare a report of investigation that took its members from coast to coast and from the Canada boundary to the Gulf. Senator R. J. Barr of Joliet, sponsor for the defeated bill, indicated that if a new measure were presented, it was likely authority would be given to municipalities to direct the issuance of permits to utilities operating within their own boundaries. Willis J. Spaulding of Springfield led champions of the "home rule" bill in an attack on what they termed "usurpation of authority" by the Illinois Commerce Commission.

Purchases and Mergers

Charleston (S. C.) Merger Completed—Eleven States Report Transfers of Various Descriptions

AS FORECAST in the ELECTRICAL WORLD for Nov. 27, the Charleston (S. C.) Consolidated Railway & Lighting Company, the Charleston Consolidated Railway, Gas & Electric Company, the Charleston-Edison Light & Power Company and the Charleston Gas Light Company have been merged to form the South Carolina Power Company, a twenty-million-dollar corporation. This announcement is made by W. P. Blackwell, Secretary of State for South Carolina. The South Carolina Power Company acquires all of the rights and powers of the four companies, the stock of which, by agreement, is to be exchanged for stock in the new company. It is understood that the South Carolina Power Company is to form part of the Southeastern Power & Light Company's system.

A merger of the Newport News & Hampton Railway, Gas & Electric Company with the Virginia Public Service Company was announced on Dec. 21. This completes the unification of Fitkin utility holdings in Virginia, the Alexandria Light & Power, the Virginia Western Power, the Northern Power and the Southside Virginia Power Companies having been merged with Virginia Public Service previously.

Thirty-five electric properties in Texas formerly owned by the Texas Public Utilities Company and the Mineral Wells Electric Company have been taken over by the Texas Power & Light Company. Both the companies first named have previously been associated with the purchasing company under Electric Bond & Share control, so that no change in basic ownership is involved. The properties transferred, as listed by C. E. Calder, president of the Texas Power & Light Company, are situated at Brenham, Lampasas, Copperas Cove, Killeen, Llano, Lometa, San Saba, Cameron, Buckholtz, Pettibone, Sulphur Springs, Como, Cooper, Clarksville, Annona, Lufkin, Bellville, Bastrop, Lockhart, Dale, Lytton Springs, San Marcos, Martindale, Maxwell, Reedville, Staples, Kerrville, Center Point, Jackboro, Elgin, Mineral Wells, Oglesby, Marble Falls, Manor and McDade.

The electric and gas systems of the Eastern New York Electric & Gas Company of Granville, N. Y., have by authority of the Public Service Commission been transferred to the Plattsburg Gas & Electric Company. All the properties involved are Associated Gas & Electric concerns.

The New York Public Service Commission has approved the joint petition of the Northern New York Utilities, Inc., and the village of Forestport for the transfer to the company of the municipal electric lighting plant in the village. This action followed a public election. The New York Public Service Commission has also approved the petition of the Tonawanda Power Company for permission to merge the Grand Island Light & Power Corporation with the applicant company.

A petition has been filed with this commission by the Wynantskill Hydro-Electric Company, operating in a part of Rensselaer County, for consent to transfer its franchise, works and system to the Harlem Valley Electric Corporation.

The same commission has authorized the Central Hudson Gas & Electric Company of Poughkeepsie, the Dutchess Light, Heat & Power Company of Rhinebeck, the United Hudson Electric Corporation of Poughkeepsie, the Kingston Gas & Electric Company, the Ulster Electric Light, Heat & Power Company of Saugerties and the Upper Hudson Electric & Railroad Company of Catskill to consolidate into a single corporation to be known as the Central Hudson Gas & Electric Corporation. The consent is conditioned upon the new corporation agreeing to comply with all orders made by the commission affecting rates and service of the six companies.

The Pennsylvania Public Service Commission has heard a petition by the Pennsylvania Power & Light Company for the acquisition of the Juniata Public Service Company and the Middleburg Light, Heat & Power Company. The Juniata Public Service Company operates in Juniata, Perry and Dauphin Counties and the Middleburg Company in Snyder, Northumberland, Dauphin and Union Counties.

The Public Electric Light Company, St. Albans, Vt., has acquired the plant of the International Paper Company at Milton, Vt. The purchase includes three projects on the Lamoille River—the Clark water-power project with an estimated capacity of 600 kw., which is undeveloped; the main power plant at Milton with a capacity of 6,000 kw. and the tentative Woods Falls project with an estimated rating of 3,000 kw.

The Clyde River Power Company, Richford, Vt., a hydro-electric concern which has been in receivership since 1924, has been sold to John Flynn of Burlington. Mr. Flynn is president of the Burlington Traction Company and the Vergennes Power Company.

Acquisition by the McGraw Electric Company of the Freeman (S. D.) municipal electric plant is announced.

Purdy, Mo., by a vote of 92 to 1 has decided to sell the town's transmission and distribution system to the Ozark Power & Water Company, a subsidiary of the Empire District Electric Company of Joplin, Mo.

The Inland Utilities Company has contracted with the City Council of Guymon, Okla., for the purchase of the local municipal light plant. The proposition will be approved or rejected at an election Jan. 11.

Citizens of Hardy, Iowa, have voted unanimously to sell their electric distribution system to the Central Iowa Power & Light Company.

The Baker County Power Company will purchase the power, water and other plants of the city of Arlington, Ga., it is announced, following an agreement between officials of the company and the Mayor and Council. The agreement includes the payment of $60,000 for the plants and a long-term franchise.

The Georgia Southern Power Company has purchased the electric distribution systems in Helena and Soperton, Ga.

Insull Conference Held in Manchester, N. H.

A regional conference of representatives of the Insull interests in New England was held Dec. 7 and 8 at the Hotel Carpenter, Manchester, N. H., the topics covered being chiefly of commercial and public relations interest. About 200 were in attendance, including O. E. McCormick, treasurer Middle West Utilities Company, Chicago; C. J. Eaton, commercial manager, and E. L. Hinchcliff, assistant commercial manager of the Middle West company; Walter S. Wyman, president New England Public Service Company, Augusta, Me., and W. A. Buttrick, vice-president, Boston. Plans were outlined for a vigorous commercial development in northern New England during 1927. At one session Miss Sophia Malicki, chairman of the National Electric Light Association women's committee, outlined the activities of the women in the organization as scheduled for the coming year, and this was followed by a round-table discussion under the leadership of W. S. Vivian, director of public relations, Middle West company.

New York Electrical Credit Association Meets

The New York Electrical Credit Association held its thirty-first annual meeting and dinner at the Hotel Commodore, New York City, on Dec. 14. Many Connecticut, New York State and New Jersey members were present. Two principal subjects were discussed, many members taking part: "Does a Salesman Help or Hinder Business by Acting as a Collector?" and "Vicarious Credit Granting." The first discussion was led by H. H. Lippe of Newark, N. J., and the second by H. B. Carpenter of New York City. William R. Montgomery, addressed the convention on the new amended bankruptcy law. At the banquet B. C. Forbes, editor *Forbes Magazine*, gave a talk on the industrial situation.

The following were elected as directors for a term of three years: L. R. Edwards, Harvey Hubbell, Inc., Bridgeport, Conn.; C. McKew Parr, Parr Electric Company, New York City, and J. H. Lecour, Mitchell Rand Manufacturing Company, New York City.

Professors to Discuss Public Utility Regulation

At the thirty-ninth annual meeting of the American Economic Association, to be held at St. Louis, Dec. 28 to Dec. 31, one of the most important discussions will be devoted to the problem of effective public utility regulation. This will be in the form of a round-table conference and will be in charge of Dr. John Bauer of the American Public Utilities Bureau. Dr. Bauer is the author of "Effective Regulation of Public Utilities" and has written extensively in the economic and technical press on valuation and problems of public utility regulation.

The fundamental question to be considered is whether the common system of regulation has worked satisfactorily

and, if not, what can be done to make regulation effective and financially sound. The special question will be considered whether reproduction cost new or actual investment in the properties is the most suitable basis of rate making from the standpoint of effective and financially sound principles of regulation. Several aspects of this question will be briefly discussed by Prof. Robert L. Hale and Prof. J. C. Bonbright, both of Columbia University; Prof. H. G. Brown, University of Missouri; Prof. Martin G. Glaeser, University of Wisconsin, and Prof. C. E. McNeill, University of Nebraska.

Briefer News

Japan May Have 220-Kv. Transmission.—Transmission at 220 kv. on a line to connect Osaka and Fukushima, Japan, 300 miles apart, is being seriously considered in that country. The line would be so constructed as to connect all of the large hydro-electric generating and distributing companies in the densely populated area between Tokyo and Osaka.

Danville, Va., Votes by Small Margin Not to Sell Its Plant.—The voters of Danville, Va., in a referendum, on Dec. 16, decided not to sell the electric and gas utilities to the Appalachian Power Company. The vote for the sale was 1,161 and the vote against was 1,412. Three of the six city wards gave majorities for the sale. As a result of the referendum the Appalachian Power Company will be denied entry to Danville, although its transmission lines will pass near by.

St. Louis Now Terminus of Long-Distance Telephone Cable.—St. Louis has displaced Chicago as the westernmost outpost of the long-distance telephone cable from New York. A newly completed link between Chicago and St. Louis, costing $7,000,000, has been installed. The link, which is 344 miles in length and required two years to construct, was necessitated by the rapidly increasing number of calls between these three major cities as well as intermediate points.

Electrical League of Utah Comes Into Being.—The name of the Rocky Mountain Electrical Co-operative League was changed to the Electrical League of Utah and new officers and a new board of trustees were elected at the annual meeting on Dec. 13. Officers elected were: President, B. E. Rowley, Edison Electric Appliance Company; vice-president, R. M. Bleak, Utah Power & Light Company; secretary-treasurer, Miles R. Cahoon, Jr., Mountain States Telephone & Telegraph Company. An enlarged program of activities for the coming year is being planned.

Tri-City Transmission Ring to Be Completed.—Plans for a substation at East Moline, Ill., to cost $300,000, are being completed, according to R. B. MacDonald, president of the People's Power Company. Cables carried on high steel towers across the Mississippi will connect this plant with the new Riverside plant at Bettendorf, near Davenport, Iowa, thus rounding out a transmission ring for service from the East Moline, Moline and Riverside plants in the Davenport-Moline-Rock Island district.

Potomac Edison Company Cuts Residential Rates.—A voluntary reduction in residential rates has been made by the Potomac Edison Company and associated companies in western Maryland and parts of Pennsylvania, Virginia and West Virginia. The new rates give to the larger places served, with the exception of Cumberland, a net rate of 8.1 cents a kilowatt-hour. In Cumberland, where the plan of charging on the basis of the number of rooms is to be introduced, an average rate of 7½ cents will result. A total annual saving of $60,000 predicated on present consumption is estimated.

Southern and Central Illinois Connected.—A transmission link between southern and central Illinois in the shape of a 66,000-volt line operated by the Central Illinois Public Service Company and extending from its power plant at Muddy, near Harrisburg, north through Carmi, Grayville and Olney to Effingham, has been energized and gone into operation. With this line there is a continuous transmission service under Central Illinois Public Service control, from central Wisconsin through northern and central Illinois into western Kentucky, and through various interconnections Iowa, Missouri, central Illinois and southern Indiana are linked.

Shawinigan Company to Develop Ste. Anne River in Quebec.—New power development work is now being carried out on the Ste. Anne River at St. Alban, Quebec, on behalf of the Port Neuf Power Company by the Shawinigan Water & Power Company, which controls the former firm. It is the intention of the company to utilize the power possibilities of the Ste. Anne River to the greatest possible extent, and to this end the work of constructing a power house will be rushed. The new St. Alban enterprise will cost about $600,000, and it is expected that 4,000 hp. will be obtained.

Rates Reduced Again in the Capital.—The Public Utilities Commission of the District of Columbia has ordered a reduction in the residential rate for electricity, lowering it from 7 cents to 6¼ cents a kilowatt-hour, to become effective on Jan. 1. The cut is a result of the profit-sharing agreement existing between the commission and the Potomac Electric Power Company, whereby one-half of the excess profit of the company each year is applied either to a reduction in rates or improvement of service. The new rate, together with cuts in other schedules, will result in a saving of $430,000 to consumers on the present basis of consumption.

Franklin Institute Gets Coils Used by Faraday.—The Franklin Institute of Philadelphia has just been presented with two scientific treasures, parts of the coils used by Faraday in his electromagnetic discoveries. They were given to the Franklin Institute by the Royal Institute of Great Britain. "The Faraday electric coils from a scientific standpoint are priceless," wrote Sir William H. Bragg, secretary of the British institution, in transmitting the gift. "Similar coils, used by Joseph Henry, who worked along the same lines as Faraday, now are owned by Princeton University and are worth their size and weight in platinum. They could not be purchased even for that price."

Hydro-Electric Plant for the Prairies.—Lars Langloe of Olympia, Wash., has just filed for water rights on a water-power plant which will be distinctive in that it will operate in a typical prairie-land section of the state. The new plant, which, if the rights are granted, is to be completed by 1930 and will cost $1,500,000, will have an output of 25,000 continuous electric horsepower and will use 1,050 sec.-ft. of the flow of the Nisqually River, flowing westward from Mount Tacoma. The 10-mile canal through prairie lands will start at a concrete diversion dam, 3 miles north of the prairie town of McKenna, and

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 3, page 50.]

American Engineering Council—The Mayflower, Washington, D. C., Jan. 13-15. L. W. Wallace, 26 Jackson Place, Washington.

Empire State Gas and Electric Association, Electric Section—New York Edison Auditorium, 44 West 27th St., New York, Jan. 14 and 15. C. H. B. Chapin, Grand Central Terminal, New York.

Northwest Association of Electrical Inspectors—Multnomah Hotel, Portland, Ore., Jan. 17 and 18. F. D. Weber, Box 745, Portland.

National Electrical Manufacturers' Association (Supply Division)—New York, Jan. 17-21. S. N. Clarkson, 30 East 42d St., New York.

Western Association of Electrical Inspectors—Kansas City, Mo., Jan. 25-27. W. S. Boyd, 175 West Jackson Blvd., Chicago.

Electrical Supply Jobbers' Association, Pacific Division — Del Monte, Cal., Jan. 27-29. F. Overbagh, 411 South Clinton St., Chicago.

National Association of Lighting Equipment Dealers—Hollenden Hotel, Cleveland, Jan. 31-Feb. 5. G. P. Rogers, 424 Guarantee Title Bldg., Cleveland.

Northwest Electric Light and Power Association, Commercial Section, Multnomah Hotel, Portland, Ore., Feb. 10 and 11. L. A. Lewis, Washington Water Power Company, Spokane, Wash.

American Institute of Electrical Engineers—Midwinter convention, New York, Feb. 7-10; Southwestern District, Kansas City, March 17-18. F. L. Hutchinson, 36 West 39th St., New York.

Kentucky Association of Public Utilities—Brown Hotel, Louisville, Feb. 18 and 19. E. F. Kelley, Louisville Railway Co., Louisville.

Oklahoma Utilities Association—Huckins Hotel, Oklahoma City, March 8-10. E. F. McKay, 307 Local Building, Oklahoma City.

retaining its level, will bring the water to a point 4 miles west of Yelm, where there will be a fall of 230 ft. into the power-house machinery, made possible by a natural declivity of an extraordinary nature. No impounding dam will be required, as the water will be fed directly into the turbines, according to Mr. Langloe.

Hydro-Electric Power Plant for Skamania County, Wash.—W. G. Hufford of Carson, Wash., plans to build a hydro-electric plant near Carson, Skamania County, with an estimated capacity of 10,000 hp., at an approximate cost of $250,000. Carson is on the Columbia River on the Oregon boundary.

Water-Storage Possibilities in Idaho.—Engineers of the Geological Survey, Interior Department, during 1925 made two dam-site surveys and special hydraulic investigations in the Bear Valley and Stanley basins in Idaho, lying 6,200 ft. above sea level in the headwater region of Salmon River. It was found that 900,000 acre-feet could be stored in Bear Valley and diverted onto the Snake River Plains, but that such storage and diversion would require two large concrete dams, one 340 ft. and one 414 ft. high; two earthen dikes, one 140 ft. and one 50 ft. high, and two tunnels, one 8 miles and one 24 miles in length. The reservoirs created would flood 36,000 acres of land that is now in large part valuable only for grazing. If these sites were used for increasing the flow of Salmon River for developing power, the potential power of the Salmon River basin would be increased by 126,000 hp. for 90 per cent of the time and 254,000 hp. for 50 per cent of the time. The results of these surveys are contained in a manuscript report that may be examined at the office of the Geological Survey in Washington, D. C., or the district office at Boise.

Chippewa Falls Plant Seems Assured.—Early construction of the important water-power development at Chippewa Falls on the Chippewa River (noted as in contemplation in the Dec. 11 issue) by the Northern States Power Company is announced by H. M. Byllesby & Company, provided that action of the Chippewa Falls City Council, which has voted to annul proceedings to purchase the electric distribution system in Chippewa Falls from the Northern States Power Company, is not disturbed. The Chippewa Falls plant, which will be built under the supervision of the Byllesby Engineering & Management Corporation, will have a capacity of 24,000 hp. in six units of 4,000 hp. each. The development, it is estimated, will cost about $2,600,000. The dam and power house will be built about two miles below the present hydro-electric development at Wissota, which has a capacity of 45,000 hp. It will utilize existing storage facilities created by the Wissota development, operating synchronously with that plant, and will be tied in with the extensive transmission system of the Northern States Power Company in Wisconsin and Minnesota. The Chippewa Falls development will operate under a head of 30 ft. It is planned to begin the plant next year.

Men of the Industry

S. N. Clarkson Appointed to Executive Position in N.E.M.A.

S. N. Clarkson has been appointed assistant to the managing director of the National Electrical Manufacturers' Association, with headquarters at 30 East Forty-second Street, New York. Mr. Clarkson brings to his new position an intimate knowledge of the electrical merchandising field and a record of constructive work as executive secretary of the Electric Power Club. He has had a broad experience in the industrial, manufacturing and central-station branches of the electrical industry and is well known in engineering circles both in this country and abroad.

After receiving his technical training at the Sydney (Australia) Technical College, Mr. Clarkson removed to this country, engaging in practical engineering work in the Middle West. He

S. N. CLARKSON

was affiliated with the Westinghouse Electric & Manufacturing Company from 1906 to 1910, when he became industrial engineer for the Union Electric Light & Power Company of St. Louis, subsequently serving as assistant sales manager and later as sales engineer. Following a brief connection with the Milwaukee Electric Railway & Light Company, Mr. Clarkson was appointed associate Western editor of the ELECTRICAL WORLD and *Electrical Merchandising*, a position he occupied for two years, resigning to engage in consulting engineering work. At the close of 1923 he was selected as permanent secretary of the Electric Power Club, with headquarters in St. Louis. Mr. Clarkson has been active in the affairs of the American Institute of Electrical Engineers, being past-chairman of the St. Louis Section.

L. G. Marshall, formerly connected with the Boston office of Stone & Webster, Inc., is now assistant power and lighting engineer in the sales department of the El Paso Electric Company.

Charles Grunsky has been appointed gas and electric engineer of the Railroad Commission of California to succeed A. V. Guillon, who has been promoted to be assistant chief engineer. Mr. Grunsky, who is a graduate of the University of California, joined the commission in 1914 after engaging in construction work for a year. He was employed on valuation work until 1922 and since that date has been an assistant engineer in the gas and electric division for the major portion of the time.

Gage R. Cooper, formerly connected with the Houghton County Electric Light Company at Houghton, Mich., has joined the power division of Stone & Webster, Inc., as assistant engineer on meter testing for operating companies.

C. B. Luscombe Assumes New Duties

Carl B. Luscombe, formerly manager of the western division of the Public Service Company of Colorado, with headquarters at Boulder, is now assistant manager and general superintendent of the Grand Junction Electric & Gas Manufacturing Company and the Grand River Valley Railway Company, properties recently purchased by the Doherty interests. His headquarters are at Grand Junction, Col. Mr. Luscombe's affiliation with the Doherty organization dates back to 1912, when he became a cadet engineer in the Doherty Training School at Denver, following graduation from the University of Missouri.

His first assignment was to the properties at St. Joseph, Mo., but subsequently he was transferred to Cheyenne, Wyo., as manager of the Cheyenne Light, Fuel & Power Company. Two years later he removed to Boulder as superintendent of the western division of the Public Service Company of Colorado and assistant to Charles A. Semrad, general manager. When Mr. Semrad became vice-president and commercial manager of the company in the fall of 1924, Mr. Luscombe was promoted to the position of manager of the division. **Frank Henderson**, formerly local manager at Boulder, has succeeded Mr. Luscombe as division manager at that point.

Norris D. Holmes, formerly connected with the New England Power System, Worcester, Mass., is now affiliated with the Staten Island Edison Company in the capacity of chief operating engineer.

W. C. Langley, head of the firm of W. C. Langley & Company, investment bankers, and a pioneer in public utility financing, has been elected a member of the board of directors of the Long Island Lighting Company, New York.

P. E. Dufour has been appointed valuation engineer of the California Railroad Commission, effective Jan. 1, to succeed R. M. Vaughan, who recently resigned from the service of the commission. Mr. Dufour has been with the transportation division of the commission's engineering department since March, 1921, at which time he was employed to make an extensive check of the federal valuation of the steam railroads in California. He has handled

the valuation work on several of the large investigations made by the commission. Previous to his employment by the state Mr. Dufour was associated for six years with the bureau of valuation of the Interstate Commerce Commission. In addition to this work he has had considerable railroad experience, having been employed a number of years with the Southern Pacific Company.

Harold D. Gregory has joined the patent department of the American Brown Boveri Electric Corporation. Mr. Gregory is a graduate engineer from the Stevens Institute of Technology.

R. M. Vaughan, who has been in charge of valuation work in the engineering department of the California Railroad Commission for a number of years, has resigned to engage in private practice.

B. A. Tracy, who has been connected with the El Dorado plant of the Western States Gas & Electric Company, Stockton, Cal., since it was first put into operation, has resigned to affiliate himself with the Northwestern Power & Light Company, Port Angeles, Wash.

Howell Ellis, secretary of the Indiana Public Service Commission since April, 1925, has been appointed a member of the commission to succeed Samuel R. Artman, who was named by Governor Jackson to membership on the state industrial board.

H. J. Mauger, assistant to the president of the Edison Electric Appliance Company of Chicago, was elected chairman of the heating-device section of the National Electrical Manufacturers' Association at the annual meeting of that section held recently at Mansfield, Ohio.

William H. Earle, formerly superintendent of manufacture of the Rochester (N. Y.) Gas & Electric Corporation, has resigned to affiliate himself with the Koppers Construction Company. At a farewell dinner President Robert M. Searle of the Rochester utility presented to Mr. Earle on behalf of the department employees a watch, chain and knife. Alexander Beebe has been selected to succeed Mr. Earle.

M. G. Clark, formerly manager of the Burlington (Vt.) municipal light department, has been appointed manager of electric utilities of the W. B. Foshay Company in Vermont, including the Montpelier & Barre Light & Power Company, recently purchased from Charles H. Tenney & Company, Boston. F. L. Lovett, formerly manager of the Montpelier company, will remain with the Tenney organization in a capacity to be announced later.

C. C. Hillis, for the past three years president and treasurer of the Electric Appliance Company, San Francisco, has been elected vice-president of Allied Industries, Inc., of San Francisco, Los Angeles, Oakland, Seattle and Portland. Prominent for many years in the electrical industry on the Pacific Coast, Mr. Hillis has been especially active in the affairs of the Pacific division of the Electrical Supply Jobbers' Association, the California Electrical Co-operative Campaign (now the California Electrical Bureau) and the National Electrical Credit Association.

H. P. Davis Heads Radio Company Board

H. P. Davis, vice-president of the Westinghouse Electric & Manufacturing Company, in charge of manufacturing and engineering, has been elected chairman of the board of directors of the National Broadcasting Company, recently organized. In commenting on the choice of Mr. Davis, M. H. Aylesworth, president of the company, said: "The selection of Mr. Davis is, perhaps, the best symbol of the fact that no effort will be spared to develop a broadcasting service which will permanently establish the primacy of the United States in the broadcasting art as pronounced as its leadership in the radio industry and international wireless communication."

As a designing engineer and as a manufacturing executive Mr. Davis has held a prominent position in the electrical industry for a number of years. His affiliation with the Westinghouse company dates back to 1891, when he entered the detail engineering department after a short connection with the Thomson-Houston Electric Company. In 1896 he was placed in charge of the department and in 1908 he was appointed manager of the company's engineering department. Three years later his promotion to a vice-presidency followed, the position he occupies at the present time.

H. P. DAVIS

The list of patents issued to Mr. Davis shows the breadth of his interest in the chain of apparatus that constitutes every electrical installation. In addition he has done excellent creative work with arc lamps and meters, to say nothing of his activity in the field of radio broadcasting. He is a member of the American Institute of Electrical Engineers, the Electrical Society of Western Pennsylvania and other technical associations.

The directors of the National Broadcasting Company now include the following: Owen D. Young, General Guy E. Tripp, General Swope, E. M. Herr, General J. G. Harbord, David Sarnoff, William Brown, E. W. Harden and Dwight W. Morrow.

A. P. Way, formerly assistant electrical engineer of the American Electric Power Company, formerly the American Railways Company, Philadelphia, is now assistant engineer in the electrical division of the Department of City Transit, Philadelphia. Mr. Way was connected with the Wilmington & Philadelphia Traction Company, a subsidiary of the American Electric Power Company, immediately before taking his present position.

V. L. Board, general superintendent of the Public Service Company of Colorado, will head the new industrial development committee of the Denver Chamber of Commerce, according to a recent announcement. The purpose of this committee's program for the current year is to bring to completion a plan to create a loan fund for the financing of new industries in the city of Denver.

Obituary

Ernst Doctor, chief of the transformer designing office of the Austrian Siemens-Schuckert Company, died recently in Vienna at the age of 56. Mr. Doctor was well known for his work in connection with transformers and was responsible for the design, among other plants, of the 120-kv. alternating-current transformer plant for the Vienna municipal hydro-electric power station.

Edward E. Brenneman, assistant secretary and assistant treasurer of the Public Service Company of Northern Illinois, died Dec. 12 in Dixon, Ill. Mr. Brenneman had been in the treasury department of the Public Service Company for many years, having served with the Illinois Valley Gas & Electric Company prior to the organization of the Public Service Company of Northern Illinois.

Ignaz Spiro, pioneer in the development of the water-power resources in Czechoslovakia, died recently in Krummau, south Bohemia, in his seventieth year. Mr. Spiro, who was the head of a large paper-manufacturing company, was one of the first to realize the importance of the water-power resources in Czechoslovakia. He built the Hohenfurth hydro-electric station on the Moldau River in south Bohemia, which, with a capacity of 12,000 hp., is one of the largest power stations in the country.

Harry M. Giles, general superintendent of the South Philadelphia plant of the Westinghouse Electric & Manufacturing Company, died Dec. 14 in the Hotel Dennis, Atlantic City, N. J. Mr. Giles, who was 57 years of age, had been associated with the Westinghouse company since 1900. He was well known in the marine and power industry, beginning his business career as testing engineer with the Corliss Steam Engine Company of Providence, Rhode Island. Leaving this company in 1886, he joined the Calumet & Hecla Mining Company, in the capacity of chief engineer, remaining with that organization until his affiliation with the Westinghouse company in 1900 as superintendent of the Corliss engine department. He later was promoted to marine superintendent and in 1919 was transferred to the South Philadelphia plant as general superintendent.

Commission Rulings

Jurisdiction Over Allegation of Broken Contract Refused.—A customer of the Philadelphia Suburban Gas & Electric Company complained to the Pennsylvania Public Service Commission that the company named had failed to make a refund to the complainant called for by the terms of an extension contract. Specifically, the complainant alleged that more than seven consumers had been directly connected with the extension and that, notwithstanding this fact, the company had failed to refund the sum of $50 for each of said consumers, as provided by the agreement. The company contended that at the time the contract was made it was understood by both parties that upon the construction of the proposed extension, or within a short time thereafter, ten consumers, inclusive of the complainant, would take service from the extension; that it was induced to enter into the contract and incur the expense of constructing the extension upon this understanding and agreement, without which it would not have entered into it, and that there have never been ten consumers upon the extension, but only eight, inclusive of the occupant of the property of the complainant. The company further contended that the contract required complainant to take service for one year and that complainant sold her property within a short time after the contract was made to a purchaser who took service for less than one year. The commission, pointing out that the gravamen of the complaint was that the company was indebted to the complainant in a definite amount under a contract, refused jurisdiction and referred the disputants to the courts.

Utility Ordered to Give Service Despite Violation of Its Settled Installation Policy and of Alleged Contract.—The New England Telephone & Telegraph Company has been ordered by the Massachusetts Department of Public Utilities to furnish telephone service to the Hotels Statler Company, Boston, at room 727 of the Statler Building by connecting with wires now pulled from the basement of the building to that room. The company had refused to connect its service with wires not installed by its own employees on the ground that (1) so to connect its wires would be contrary to its policy and practice; (2) that the Statler company had contracted with it for the installation and wiring by telephone employees and had thereby broken its contract and so was not entitled to service; (3) that a general strike by union men on the Statler job would be illegal, and that the Statler company in yielding to the union became a co-conspirator in an illegal enterprise, and that to order the telephone company to make the connection would be aiding in achieving the object of a threatened illegal strike. In its finding the commission declared that the wires installed are of the kind usually used by the telephone company for such service and that the installation has been properly made by members of the International Brotherhood of Electrical Workers; that connecting with these wires will not impair the service of the telephone company, and that the latter will suffer little if any loss if it modifies its practice. Cases were cited wherein the telephone company has permitted others than its own workmen to install telephone wiring, and emphasis was laid upon the heavy losses inevitable to the Statler company and other owners of buildings under construction in case of cessation of work upon their structures. The board holds that the telephone company's duty to furnish service transcends its policy in this matter and that, even if the petitioner broke his contract with the company, its right to obtain service is unimpaired. The telephone company has appealed.

Recent Court Decisions

Rule for Fair Return Subject Only to Condition that Rate Must Not Exceed Value of Service.—Refusing to overrule a rate decision of the Public Service Commission of West Virginia in a suit brought against it by the city of Elkins to upset rates for natural gas, the Supreme Court of Appeals of that state reaffirmed the principle that a public service company is entitled to a fair rate upon the present fair value of its property used and useful in the public service, to be ascertained as of the time the service is rendered, subject only to the condition that a utility will never be permitted to charge more than the value of the service which it is rendering. (135 S. E. 397.)*

Company Not Responsible for Death of Employee Who Tried to Repair Transformer Without Instructions to Do So.—Deboe's Administrator vs. West Kentucky Coal Company was a suit for damages because of the death of a hoisting engineer employed by the coal company. This man was sent with a message to utility company workmen who were investigating failure of electric service and who had turned off the electric current. Failing to find the utility men, the man climbed on a transformer, knowing that the governing switch was closed, and sought the cause of the trouble himself. While so engaged the repairmen finished their work and reopened the switch, the hoisting engineer being killed in consequence. The Court of Appeals of Kentucky upheld a directed verdict for the defendant because there was no evidence that the victim had been told to attempt repairs on the transformer on this occasion. Evidence that on previous occasions he had been told to make minor repairs did not establish responsibility on the part of his employer, since on those occasions it may have been perfectly safe to come in contact with that equipment. (287 S. W. 568.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Electrical Equipment Not Taxable as Real Estate in District of Columbia.—Electric light poles, wires, conduits and lamps are not real estate and cannot be taxed by the District of Columbia as such, according to an opinion rendered in equity by the District Supreme Court in a suit whereby the Potomac Electric Power Company sought to restrain the District from collecting $190,614. The District proceeded on the theory that this kind of equipment became real estate when annexed to the soil, but the court found that the law did not uphold this contention. "There has," it said, "been no clear indication of the legislative will that the articles in question should be taxed as real estate at all, and certainly none that they should be taxed at their cost price merely because they have been annexed to the soil of the highways in the manner shown, under the provision granted and for the purpose agreed."

Contract Suspended When Commission Approves of New Rates Filed with It.—The Seneca Iron & Steel Company of Blasdell, N. Y. must pay a bill for increased electrical rates charged by the Niagara, Lockport & Ontario Power Company if, as it is contended, the power concern filed the schedule of increased rates and obtained approval of the New York Public Service Commission. Such is the effect of an order handed down in the Supreme Court of the state. The Blasdell company in 1906 entered into a contract with the power company to buy electrical energy at a fixed schedule of rates, the contract to continue until 1937. In 1925 the power company raised the rates. The Blasdell company argued that this was a violation of the contract and has continued to pay at the old rates. The power company brought suit to recover $10,000 alleged to be owing. The Supreme Court holds that the only issue is whether, as the power company claims, the new rates were filed with and approved by the commission.

What Is an "Attractive Nuisance"?—The Nebraska Supreme Court has ruled that the fact that long, swaying cables of light wires suspended on bridges across streams are a lure to adventurous youths does not bring them within the scope of "attractive nuisances," which are defined to be such mechanical devices or set-ups as prove so alluring that judgment and caution are banished from youthful minds and children are unable to resist playing with them. Where this is a fact the owner is required to exercise a greater degree of care than ordinary and furnish adequate protection against accident and loss of life. The Omaha & Lincoln Railway & Light Company had been sued for $25,000 for the death of a fifteen-year-old boy named Reinhold Hron who grabbed hold of a live wire and was killed by being thrown to the ground underneath the bridge, and the district court held that the company owed him no other duty than not wantonly to injure him while he was playing about the bridge and that the doctrine of attractive nuisances does not apply. The Supreme Court has upheld the lower court's action in directing a verdict for the company.

Financial and Corporate

Utility Market Quiet

Very Little Activity Is Recorded for Light and Power Issues During Past Week

THERE has been no outstanding movement either one way or the other in the markets for public utility securities during the week under review. Very few price changes occurred either among common or preferred issues, the market lacking the buoyancy which has been characteristic of late. Slight losses were reported among the common shares by the American Gas & Electric, Electric Investors, Consolidated Gas, Electric Light & Power of Baltimore and Detroit Edison. The average price of a representative group of fifteen stocks remained at the same point reported for last week.

What is true of the common stocks applies also to the preferred shares. The market was exceedingly quiet but steady. Prices in the bond market displayed a firm tone, though interest was small. An interesting feature this week was the issuance by the Commonwealth Power Corporation of an earnings statement for the year to Nov. 30, which showed net earnings after preferred dividends and retirement of reserve of $4.05 a common share as compared with $2.13 a share for the similar period of 1925.

Company Reports

The following statements of earnings have been issued by electric light and power companies for the month of November:

Name of Company	Gross Earnings for November 1926	1925
Adirondack Power & Light	$847,668	$750,501
Alabama Power	1,259,828	1,065,065
American Power & Light	*5,015,931	*4,564,254
Cities Service	2,274,189	1,557,064
Idaho Power	*224,693	*211,328
Southern Canada Power	129,169	115,773
Utah Power & Light	*896,293	*838,325

* October.

Columbia Gas & Electric to Issue Additional Stock

Directors of the Columbia Gas & Electric Corporation have authorized the issuance and sale to common-stock holders of record Jan. 20, 1927, of 375,000 additional shares of common stock (no par value) at $60 per share on the basis of one new share for each eight shares held. Subscriptions are payable on or before Feb. 25. This piece of financing will raise approximately $22,500,000, part of which will be applied to refinancing of nearly $11,000,000 of bonds and debentures due Jan. 1, 1927, thereby reducing interest and sinking-fund requirements by more than $650,000 annually. The balance will be devoted to other corporate purposes.

Subscribers who wish to make payment in four installments may pay $15 per share on the twenty-fifth day of February, May and August, 1927, and $13.65 per share on Nov. 25, 1927. Subscribers who wish to pay in full on or before Feb. 25, 1927, may do so by paying $61.05 per share. Subscribers who have paid the first installment of $15 per share and wish to complete their subscription payment on or before May 25, 1927, may do so then by paying $45.47½ per share. Subscribers who have paid the first two installments of $15 each per share and wish to complete their subscription payment on or before Aug. 25, 1927, may do so then by paying $29.67½ per share.

Interstate Public Service Simplifies Set-up

Underlying Issues of Company Are Reduced from Twenty-one to Four—New Coupons Have Lower Average than Former Issues

CAPITAL structure simplification among the power and light companies is in the air. The most recent example is the Interstate Public Service Company, part of whose first and refunding issue of $10,000,000, sold a few days ago, is being used to retire a large number of outstanding issues.

As a consequence of the present program of financing, the structure of Interstate Public Service will be radically simplified. The number of underlying bond issues is to be cut from twenty-one to four, as indicated in the diagram below. Something of the actual saving effected is seen from the fact that one of the issues being retired carried a 7½ per cent coupon rate, one a 6½ coupon; five bore 6 per cent interest and one 5½ per cent. The total annual interest on these higher-priced issues was more than $311,000 against the new interest requirement of $256,000 on an equivalent amount. More important than this, however, is the fact that the company's set-up will not be burdened with miscellaneous issues complicating the situation and making it more difficult to finance possible expansion. The first and refunding mortgage bonds of which the new issue is a part will be the only outstanding Interstate Public Service Company bonds. In addition to retirement purposes, the new funds will be used for property additions and extensions and for other corporate purposes.

Present Simplification Program

The present simplification program, in the form of retirement of old issues, has been under way for some time. Under the terms of the first mortgage dated Feb. 1, 1923, the company last year issued and sold $3,159,000 first mortgage and refunding gold bonds, the proceeds of which were used partly to retire $619,200 of divisional under-

Bonds to Be Redeemed

	Bonds	Amount	Call Price
Central Ind. Ltg. Co. —	1st 5s, due 5/1/27	$288,500	102
Ind. Public Serv. Co. —	1st 5s, due 1/1/31	100,000	105
Shelby Co. W., G. & E. Co. —	1st 5s, due 3/1/30	201,800	102½
United Gas & Elec. Co. —	Con. 5s, due 7/1/42	46,000	105
Jeff. W., L. & P. Co. —	1st 5s, due 2/1/30	92,500	105
Franklin W., L. & Pr. Co. —	1st 5s, due 4/1/29	117,500	100
Warsaw Gas Company —	1st 5s, due 4/1/43	18,000	102
Goshen Gas Company —	1st 6s, due 6/1/27	60,000	100
Goshen Gas Company —	1st 5s, due 12/1/42	11,000	102
Indianapolis & Lou. Tr. Co. —	1st 5s, due 4/1/42	817,600	105
Indiana Power Co. —	1st 6s, due 11/1/44	454,500	105
Indiana Power Co. —	1st l. & g. "B", 6½s, due 11/1/41	1,175,000	105
Indiana Power Co. —	Three-year 5½s, due 2/1/28	1,000,000	100½
Indiana Power Co. —	S.f. 7½s, due 11/1/41	16,300	....
Indiana Pr. & Water Co. —	1st 6s, due 9/1/36	1,834,300	103
Orange Co. P. S. Co. —	1st 6s, due 4/1/36	50,000	....
I. Car Trust Equip. —	Notes, 6 & 7s, due serially	597,500	102

Bonds to Be Outstanding

	First mortgage & refunding 5s	.....	$24,052,100
	Underlying Divisional Bonds:		
United Gas & Elec. —	1st 5s, due 7/1/42	$489,000	
People's Gas, Elec. & Ht. —	1st 5s, due 8/1/27	82,000	
New Albany Street R.R. Co. —	1st 5s, due 8/1/27	192,000	
Indiana Power —	1st lien. & gen. mtg. 7½s, due 11/1/41	1,248,500	2,010,500
			$26,062,600

SIMPLE STRUCTURE RESULTING FROM RETIREMENT OF SUBSIDIARY COMPANIES' ISSUES

lying bonds either matured or of relatively early maturity. The capital set-up is now comparatively simple. There were outstanding at the end of last year two common issues totaling $8,804,125, two preferred issues totaling $15,291,200 and bonded indebtedness to a total of $23,136,300 made up of the miscellaneous issues already referred to. After completion of the present retirement process the only bond issues will be those shown in the diagram.

TERRITORY SERVED

The company serves directly or indirectly more than 200 towns and cities in Indiana with one or more classes of public utility service and operates an interurban line connecting Indianapolis and Louisville. The rapidity of its growth is seen from the fact that the number of communities served at the end of 1924 was 135. Merchandise sales for the year 1925 showed an increase of almost 50 per cent over the previous year. Operating revenues at the end of 1925 had increased in a year by 31 per cent to $8,916,454, and net income made the unusually large expansion record of 60 per cent to $2,940,870. Operating expenses and taxes advanced from $4,988,025 to $5,965,584.

New Capital Issues

First lien collateral 30-year 5½ per cent gold bonds, series A, of the Central West Public Service Company were offered during the week under review at 99 and accrued interest, to yield about 5.55 per cent. This piece of financing involved a total of $4,000,000. These bonds will be a direct obligation of the company and upon completion of the financing will be secured by a first lien on all the bonds, mortgage notes and capital stocks to be outstanding (except directors' qualifying shares and negligible minority interests) of all subsidiaries, except two small companies.

The Central Power & Light Company issued 17,500 shares of 7 per cent cumulative preferred stock during the week.

An additional issue of first mortgage and refunding 30-year 5 per cent gold bonds was offered by the Niagara, Lockport & Ontario Power Company, amounting to 3,750,000. These series A bonds, due April 1, 1955, were priced at 100.

West Penn Shares Offered Locally.—Ten thousand shares of the West Penn Power Company 6 per cent cumulative preferred stock are being offered by the West Penn Securities Department, Inc., at $100 per share. The stock may be purchased for cash or on a monthly payment plan. Application has been made for the listing of this stock on the New York Stock Exchange. The stock is redeemable as a whole or in part upon six months' notice at 110 and accrued dividends and is exempt from the present Pennsylvania 4-mill tax.

Recent Listings Made on Chicago Exchange.—The Chicago Stock Exchange has admitted to the list 7,500 shares (no par value) of preferred stock (without warrants) of the Central Gas & Electric Company, which with 21,000 preferred shares (with warrants) already on the list make the total amount listed 28,500 shares. There have been also admitted to the Chicago Stock Exchange list 25,000 additional shares of common stock (no par value) of the Central & South West Utilities Company, making the total listed and outstanding 510,000 shares.

Hydro-Electric Securities Corporation Increases Capital.—For the third time the Hydro-Electric Securities Corporation of Quebec has been granted supplementary letters patent, which

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

	Bid Price Monday Dec. 20	Low 1926	High 1926
ABITIBI PWR. & PAPER, com.			
—no par	k 87	70¼	98
Adirondack Pwr. & Lt.—7% pf.	104	....	....
Adirondack Pwr. & Lt.—8% pf.	109½	....	....
Ala. Pwr., pf.	107	....	....
Allis-Chalmers Mfg. pf.	111½	105	111½
Allis-Chalmers Mfg., com.	92	78¼	94¼
Aluminum Co. of Amer., com.	71	....	....
Aluminum Co. of Amer. pf.	102	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	88	79	98
Amer. & Foreign Pwr., com.—no par	18	14½	42¾
Amer. Bosch Magneto, com—no par	17½	16	34¾
Amer. Brown Boveri, Elec.	38¼	30½	50
Amer. Brown Boveri, Elec., pf.	k 97	86½	97½
Amer. Gas & Elec., 6% pf.—no par.	97	90½	97½
Amer. Gas & Elec., com.—no par.	102	64	111½
Amer. Lt. & Trac., 6% pf.	l115	105	132
Amer. Lt. & Trac., com.	235½	193	263
Amer. Pwr. & Lt., 6% pf.	97¼	92	99½
Amer. Pwr. & Lt., com.—no par.	62½	50¼	72½
Amer. Pub. Serv., 7% pf.	a 96	....	....
Amer. Pub. Serv., com.	e 50	45	80
Amer. Pub. Utilities, 6% pf.	75	....	....
Amer. Pub. Utilities, 7% pf.	87	....	....
Amer. Pub. Utilities, com.	m 66	....	....
Amer. States Sec., A	31	....	....
Amer. States Sec. B	a 4	....	....
Amer. Superpwr., pf.—25	26½	23	26¾
Amer. Superpower, pf.	k 93½	....	....
Amer. Superpwr., Class A—no par.	27½	19½	37¾
Amer. Superpwr., Class B—no par.	29	21¼	39
Amer. Wtr. Wks. & Elec., 7% pf.	k106½	101½	108¾
Amer. Wtr. Wks. & Elec., com.—20.	63¾	43¾	74
Anaconda Copper	48¼	41¼	51¾
Appalachian Elec. Pwr., 7% pf.	l 99	90	101
Appalachian Elec. Pwr., 1st pf., 7%	l 98	....	....
Appalachian Elec. Pwr., com.	m 78	....	....
Arizona Pwr., 7% pf.	73	....	....
Arizona Pwr., com.	22	....	....
Arkansas Cent. Pwr., pf., $7—no par	k100	99	107
Arkansas Lt. & Pwr., 7% pf.—no par	101½	....	....
Arkansas Lt. & Pwr., com.—no par	100	110	115
Asheville Pwr. & Lt., 7% pf.—no par	l107½	100½	107½
Assoc. G. & E., pf.—$3.50—50	50	....	....
Assoc. Gas & Elec., pf.—$6—no par	86	....	....
Assoc. Gas & Elec., Class A—no par	36¼	25½	38¾
BABCOCK & WILCOX, com.	116	....	....
Binghamton Lt., Ht. & Pwr., pf.	l 92	90	95
Birmingham Elec. pf.—$7—no par.	105½	....	....
Blackstone Valley Gas & Elec., pf.	l103	103	106
Blackstone Valley G.&E., com.—50.	k100	100½	106
Blaw-Knox, com.	l 72	45	80
Brazilian Trac., Lt. & Pwr., com.	l105¼	....	....
Broad River Pwr., pf.	94	....	....
Brooklyn Edison, com.	154½	133	163
Buffalo, Niagara&East.Pwr.,pf.—25.	l 24	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par.	l 28½	....	....
CALIFORNIA ELEC. GENERATING, pf.	l 95	89	95
California Ry. & Pwr., pf.	l125	88	130
Carolina Pwr. & Lt., pf.—$7—no par	107½	....	....
Cent. & S. W. Ut. 7% pf.—no par.	a 93½	89½	96¼
Cent. & S. W. Ut., pr. ln. pf.—no par	a 99	93	100
Central Ariz. Lt. & Pwr., pf.	105	....	....
Central Ark. Ry. & Lt., 7% pf.	100	....	....
Central Ill. Pub. Serv., 6% pf.	a 89½	....	....
Central Ind. Pwr., 7% pf.	l 85	84½	95½
Central Pwr. & Lt., pf.	100	....	....
Central States Elec., 7% pf.	90	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	m117	110	117
Chicago Fuse Mfg., com., no par.	a 31	30	35
Cincinnati Gas & Elec., com.	g 93	....	....
Cities Service, 6% pf.	l 92½	86½	92½
Cities Service, pf.B—10.	l 8¼	7¾	8¼
Cities Service, pf. BB—100.	l 82½	74	82½
Cities Service, com.—20.	l 49½	37½	49½
Cities Service, Bks. Shrs.—10.	l 24½	19½	24½
Clarion River Pwr., pf.	l 95	93	95
Cleveland Elec. Illg., 6% pf.	108	....	....
Cleveland Elec., Illg., com.	300	....	....
Colorado Pwr., 7% pf.	l 95	96	97
Columbia Gas & Elec., 7% pf.	k116½	111½	117½
Columbia Gas & E., com.—no par.	88½	85½	91
Columbia Ry., Gas & Elec., 6% pf.	l 94	65	96
Columbus Elec. & Pwr., 2d pf.	104	....	....
Columbus Elec. & Pwr., new com.	55	....	....
Columbus Ry., Pwr. & Lt., 1st pf.	98	....	....
Columbus Ry., Pwr. & Lt., pf. B.	93	....	....
Col. Ry., Pwr. & Lt., com.—no par.	70	....	....
Commonwealth Edison, com.	a138	....	....
Commonwealth Pwr., 6% pf.	93	82	93½
Commonwealth Pwr., com—no par.	41½	28½	43¾
Conn. Lt. & Pwr., 8% pf.	118	....	....
Conn. Lt. & Pwr., 7% pf.	111	....	....
Cons. Gas of N. Y., pf.—50.	62	....	....
Cons. Gas of N.Y., com.—no par	111	87	115½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	c106	102	107½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½% pf.	c111	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	c114	109	115
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	c126½	124	128¾
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	c 51¼	....	....
Cons. Pwr. & Lt., 7% pf.	106	....	....
Consumers Pwr., 6% pf.	100	....	....
Consumers Pwr., 6.6% pf.	103	....	....
Continental Gas & Elec., 7% pfc. pf	105	....	....
Continental Gas & Elec., 7% pr. pf.	98½	....	....
Continental G.&E., com.—no par.	200	....	....
Crocker Wheeler, com.	26	....	....
Crocker Wheeler, pf.	65	....	....
DALLAS PWR. & LT., 7% pf.	107	....	....
Dayton Pwr. & Lt., 6% pf.	101	....	....
Detroit Edison, com.	136½	123½	141½
Dubilier Condenser com.—no par.	k 4¼	3½	11
Dubuque Elec., 6% pf.	l 94	93	98½
Duquesne Lt., 7% pf.	k115½	111½	116½
EAST, N. Y. UTIL, pf.	l102	80	104
Eastern New York Util., com.	l 65	70	75
Eastern States Power.	11	....	....
Eastern States Power, pf.	92	....	....
Eastern Tex. Elec., 7% pf.	104	....	....
East. Tex. Elec., com.—no par.	l 75	70	80
Edison Elec. Illum. of Boston, com.	d230	....	....
E. Paso Elec., com.—no par.	l 70	70	94
E. Paso Elec. pf.	105	....	....
Elec. Bond & Share, 6% pf.	l109	103½	109½
E. Bd. & Share Sec., com.—no par.	l 69	56½	86
El. Household Util.	a 15	....	....
Elec. Investors, 6% pf.—no par.	92½	....	....
Elec. Investors, com.—no par.	38¼	30½	74¼
Elec. Investors, 10% pd. receipts.	l 20	12	56
Elec. Pwr. & Lt., ctfs, pf.	k 95½	89½	98½
Elec. Pwr. & Lt., ctfs., 40% pd.	k104	99½	115
Elec. Pwr. & Lt., ctfs. full pd.	k103½	102½	110¾
Elec. Pwr. & Lt., ctfs., com—no par.	17½	15½	34½
Elec. Refrig.	37½	33½	78½
Elec. Ry. Securities, com.—no par.	k 5½	4¼	10
Elec. Storage Battery, com.—no par.	83½	71½	94¼
Elmira Wtr., Lt. & R. R., 7% pf.	l 99	97½	99½
Emerson Elec., pf.	m105	101	105
Empire Power, A.	28	....	....
Engr. Pub. Serv., pf.—no par.	m 94	92½	96½
Engr. Pub. Serv., com.—no par.	23	19½	24½
Eureka Vac. Cleaner, com.—no par.	67½	43	68½
FAIRBANKS MORSE, pf.	109½	106½	115
Fairbanks Morse, com.—no par.	42½	40½	59½
Federal Lt. & Trac., com.	42½	28	47½
Federal Light & Traction, pf.	94	86	94
Federal Utilities, pf.	m 70	....	....
Federal Utilities, com.	m 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	f109½	105	109½
GALVESTON-HOUSTON ELEC., 6% pf.	67	....	....
Galveston-Hstn. El., com.	25	....	....
Gen. Elec., com.	87½	79	95½
Gen. Elec., special—10.	11½	11	11½
Gen. G.&E., (Del.) com. A no par.	k 42½	34	59
Gen. G.&E., (Del.) com. B no par.	m 42	36	48¾
Gen. G.&E., (Del.) A pf. $8 no par.	k112	105½	113
Gen. G.&E., (Del.) A pf. $7 no par.	k 98	95	100
Gen. G.&E., (Del.) pf. B.	k 93	92½	96
General Public Service, pf.	m103	100	106
General Public Service, com.	m 11½	11	16½
Ga. Lt., Pwr., & Rys., 6% pf.	l 88	82	98
Ga. Lt., Pwr. & Rys., com.	m 60	65	80
Ga. Ry. & Power, 8% pf.	k120	112	122
Ga. Ry. & Power, 7% pf.	106	....	....
Ga. Ry. & Pwr., 4% pf.	m119	....	....
Ga. Ry. & Pwr., com.	120	....	....
Gt. Western Pwr., 7% pf.	h102	....	....
IDAHO PWR., 7% pf.	104½	....	....
Ill. No. Utilities, 6% pf.	k 88	88	92
Ill. Pwr. & Lt., 7% pf.	98½	....	....
Ingersoll Rand	k 92	80½	104
Int. Combus. Engr., com.—no par	46½	33½	64½
Int. Utilities, class A—no par.	29	25	39
Int. Utilities, class B—no par.	3½	3½	9¼
Interstate Pwr., pf., no par.	93	....	....
Interstate Pub. Serv., 7% pf.	l 97	96½	99
Iowa Ry. & Lt., 7% pf.	l 96	98	100
JERSEY CENTRAL PWR. & LT., 7% pf.	97½	....	....
Jersey Central Pwr. & Lt., pfc., pf.	l107	95½	112
Jersey Central Pwr. & Lt., com.—no par	k 25	25	50
Johns-Manville, com.—no par.	k179½	130	183½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high. Saturday, Dec. 18. lBid, low, high, Tuesday, Dec. 21. mLatest quotations available.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

	Bid Price Monday Dec. 20	Low 1926	High 1926
KANSAS CITY PWR. & LT., pf.	114¼	107¼	115
Kansas Gas & Elec., 7% pf.	*103¼	99	103½
Kentucky Hydro-Elec., pf.	a 94¼	91¼	95½
Kentucky Sec., 6% pf.	81¼	....	....
Kentucky Sec., com.	107	....	....
Kentucky Utilities, 6% pf.	l 95	90	95
Keystone Pwr. & Lt. 7% pf.	l 97	95	97
LA CLEDE GAS L T., com.	£185	146	196¼
Lehigh Pwr. Sec., com.—no par	15¼	10	22
Long Island Ltg., 7% pf.	110¼	....	....
Long Island Ltg., com.—no par	*130	120	150
Los Angeles Gas & Elec., 6% pf.	98¼	....	....
Louisville Gas & Elec., Class. A	24	22¼	26¼
MANHATTAN ELEC. SUPPLY.	56¼	44	87½
Manila Elec., com.—no par	£ 38½	27½	45¼
Maytag Mfg., com.	23¼	10	24¼
Memphis Pwr. & Lt., pf., $7, no par	*108½	103	109
Metro. Edison, pf.—$6—no par	94	....	....
Metropolitan Edison, pf., $7, no par.	103	....	....
Metropolitan Edison, com., no par.	l 55	45	55
Middle West Utilities, 7% pf.	a107½	....	....
Middle West Utilities, 7% pr. lien pf.	a117½	....	....
Middle West Utilities, com.—no par.	a112	....	....
Midland Utilities, pr. In. pf.	a 99	....	....
Midland Utilities pf. A.	a 98	96	99½
Milwaukee Elec. Ry. & Lt., 7% pf.	m101	....	....
Milwaukee Elec. Ry. & Lt., 6% pf.	m 97	....	....
Minn. Pwr. & Lt., 7% pf.	*104½	100	104½
Miss. Pwr. & Lt., pf.	107	....	....
Miss. River Pwr., 6% pf.	94	....	....
Miss. River Pwr., com.	60	....	....
Mohawk Hudson Pwr., 1st pf.—$7 no par.	105½	....	....
Mohawk Hudson Pwr., 2nd pf.—$7—no par.	99	....	....
Mohawk Hudson Pwr., com.—no par	21½	20½	28¼
Montana Pwr., pf.	m117½	112¼	119¼
Montana Pwr., com.	83¼	69¼	86¼
Montreal Pwr., com.	f 69½	....	....
Mountain States Pwr. pf.	97½	....	....
Mountain States Pwr., com.	18	....	....
NASSAU & SUFFLOK, LTG., pf.	97	....	....
National Carbon, pf.	a130	124	130
National Electric Pwr-A.	23¼	15¼	26¼
National Elec. Pwr., pf.	a 94	....	....
Nat. Lt., Ht. & Pwr., com.	l 24	22	25
National Lt., Ht. & Pwr., 5% pf.	l 70	71	73
National Pwr. & Lt., pf., $7 – no par	101½	96	105
National Pwr. & Lt., com.—no par.	20½	16¼	38½
National Pub. Serv., 7% pf.	90	....	....
National Pub. Serv., pte. pf.	107	....	....
National Pub. Serv., A com.—no par.	18¼	15¼	24
National Pub. Serv., B com.—no par.	13½	10	17½
Nebraska Pwr., 7% pf.	*107½	103	107½
Nevada-Calif., Elec., com.	k 27	18¼	44½
New Brunswick Pwr., pf.	l 58	30	60
New England Pub. Serv., pr. In. pf.	l 99½	98	99½
New England Pub. Serv., pf.	l 95	95½	97
N. J. Pwr. & Lt., 7% pf.	m109½	....	....
New Orleans Pub. Serv., 7% pf.	105	....	....
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	....	....
N. Y. Central Elec., 7% pf.	l 98½	98	100
Newport News & Hampton Ry., Gas & Elec., com.	*109	98	112
Newport News & Hampton Ry., Gas & Elec., pf.	*109	98	114
Niagara Falls Pwr., 7% pf.—25	29	27½	29½
Niagara, Lock. & Ont. Pwr., 7% pf.	*109	110	111½
No. Amer., 6% pf.—50.	£ 50½	49	52½
No. Amer., com.—10.	47½	42	67
No. Amer. Edison pf.—no par.	96½	91½	96½
No. Amer. Lt. & Pwr., pf.	*101	88	104
No. American Utilities, pf., full pd.	m 94½	89	96
No. American Utilities, pf., 25% pd.	m 19	18	27
N.C. Pub. Serv., pf.—$7—no par	93	....	....
Northeastern Pwr., com.	16½	15½	36½
No. Indiana Gas & Elec., pf. A.	*102½	98	103½
No. N. Y. Utilities, 7% pf.	s104	....	....
No. Ohio Pwr., com.—no par	9½	9½	26¼
No. Ohio Trac. & Lt., 6% pf.	l 76	78	81
No. Ohio Trac. & Lt., 7% pf.	l 92	88	96
No. Ont. Lt. & Pwr., pf.	83	....	....
No. Ont. Lt. & Pwr., com.	l 74	....	....
No. States Pwr., 7% pf.	103½	99½	103½
No. States Pwr. com.	£113½	98½	136½
No. Texas Elec., 6% pf.	58	....	....
No Texas Elec., com.	23	....	....
OHIO BRASS, com. B –no par	l 77	70	80
Ohio Brass, pf.	*101	98	101
Ohio Gas & Elec., 7% pf.	l 94	40	95
Ohio Pwr., 6% pf.	l 95½	60	96
Ohio Pub. Serv., 6% pf.	l 94½	90	96½
Ohio Pub. Serv., 7% pf.	*104	96	104
Ohio River Edison, pf.	104	....	....
Oklahoma Gas & Elec., pf.	96	....	....
PACIFIC GAS & ELEC., 6% pf.	100½	....	....
Pacific Gas & Elec. com.	130½	118	133½
Pacific Pwr. & Lt., 7% pf.	*102½	98	102½
Parr Shoals Pwr., 6% pf.	l 92	....	....
Penn Central Lt & Pwr., pf.—no par	c 73	....	....
Penn-Ohio Edison, 7% pf.	97	....	....
Penn-Ohio Elec., 7% pf.	l 95	93	96
Penn-Ohio Pwr. & Lt., 7% pf.	98	....	....
Penn-Ohio Pwr., & Lt., 8% pf.	106	....	....
Penn Pwr. & Lt.—$7—no par.	*105½	103	108½
Penn Pub. Serv., 7% pf.	*103	96	103
Penn Pub. Serv., 6% pf.	l 87	85	90
Penn Wtr. & Pwr., com.	e176½	....	....
Phila. Co., 6% pf.—50.	49½	45	51½
Phila. Co., com.—50.	89½	59½	91
Phila. Elec., com.—25.	c 51½	....	....
Pittsburgh Utilities, pf.—10.	m 19½	14½	20½
Portland Elec. Pwr., 7% pf.	96	....	....
Portland Elec. Pwr., 6% pf.	82	....	....
Portland Elec. Pwr., 6% 2nd pf.	70	....	....
Portland Elec. Pwr., com.	28	....	....
Potomac Elec. Pwr., pf.	m107½	....	....
Pwr. Corp. of N.Y., com.—no par.	m 79	77½	90½
Pwr. Sec., pf.—no par.	37	....	....
Pwr. Sec., com.—no par.	k 6	4	13
Pub. Serv. of Colorado 7% pf.	l 99	96	100
Pub. Serv. of N. J., 7% pf.	£109	103½	110
Pub. Serv. of N. J., 8% pf.	£122½	115	124½
Pub. Serv. of N. J., com.—no par.	32½	31½	33½
Pub. Serv. of No. Ill., 6% pf.	a102½	99½	106
Public Serv. of No. Ill., 7% pf.	a113	....	....
Pub. Serv. of No. Ill., com.—no par.	a132	121	140
Pub. Serv. of No. Ill., com.	a131½	128	143
Pub. Serv. of Okla., 7% pf.	l 98½	92	100
Pub. Serv. Elec. & Gas, 6% pf.	£102½	97	104½
Public Service Elec. Pwr., pf.	£113½	106	114
Puget Sound Pwr. & Lt., 7% pf.	103	....	....
Puget Sound Pwr. & Lt., 6% pf.	83	....	....
Puget Sound Pwr., & Lt., com.	32½	....	....
RADIO CORP. OF AM., pf.—50	53½	44½	53½
Radio Corp. of Amer., com.—no par.	60½	32	61½
Republic Ry. & Lt., pf.	120	....	....
Republic Ry. & Lt., com.	112	....	....
Rochester Gas & Elec., 5% pf.	m 95	....	....
Rochester Gas & Elec., 6% pf.	£102½	100	103
Rochester Gas & Elec., 7% pf.	106	....	....
SAN JOAQUIN LT. & PWR., 7% pf.	s106	97½	108
Safety Cable, com.	52½	42½	55½
St. Joseph Ry., Lt., Ht. & Pwr., pf.	l 67	60	70
Servel Corp.	k 8½	5½	22½
Sierra Pacific Elec., com.	24½	....	....
Sioux City Gas & Elec., 7% pf.	100½	....	....
S. E. Pwr. & Lt., pf.—$7—no par.	*101½	....	....
Southeastern Pwr. & Lt., pte. pf.	l 67½	....	....
S. E. Pwr. & Lt., com.—no par.	k 30½	20	46½
So. Calif. Edison, 8% pf.—25	l 34	32½	36½
So. Calif. Edison, 7% pf.—25	k 27	27½	28
So. Calif. Edison, 6% pf.—25	24½	24½	25½
So. Calif. Edison, com.	30½	30½	33
Southern Cities Utilities, 7% pf.	85	....	....
Southern Cities Utilities, com.	a 34½	....	....
Southwestern Lt. & Pwr., A.	60	....	....
Southwestern Lt. & Pwr., B.	60	....	....
Southwestern Lt. & Pwr., $6 pf.	82	....	....
Southwestern Pwr. & Lt., 7% pf.	£104	100	105
Springfield (Mo.) Ry & Lt., 7% pf.	l 97	95	100
Standard Gas & Elec., 8% pf.	57	53½	57½
Standard Gas & Elec., 7% pf.	*105½	102	105½
Standard Gas & Elec., com.—no par.	57½	51	69
Standard Pwr. & Lt., 7% pf.	97	....	....
Staten Island Edison, pf.–$6–no par	96	....	....
Superheater, com.—no par.	168	....	....
Syracuse Lighting, 7% pf.	*102	105	107
Syracuse Lighting, 8% pf.	*115	....	....
Syracuse Lighting, com.	*340	260	355
TAMPA ELEC., com.	48½	45½	67
Tenn. Elec. Pwr., 6% pf.	92	....	....
Tenn. Elec. Pwr., 7% pf.	103	....	....
Terre Haute, Ind. & East Trac., pf.	l 20	20	37
Terre Haute, Ind. & East. Trac., com	1	1	7
Tex. Pwr. & Lt., 7% pf.	l 107½	102	107½
Tide Water Pwr., 8% pf.	105	....	....
Timken Roller Bearing, com—no par	81¼	44½	85½
Toledo Edison, 8% pf.	*114	111	114
Toledo Edison, 7% pf.	*103	101	103
Toledo Edison, 6% pf.	l 94½	90	95
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	l 90	87½	90
UNITED GAS & ELEC., 6% pf.	97½	....	....
United Gas & Elec., com.—no par.	m 57	56	66
United Gas & Elec. (N.J.), 5% pf.	71	....	....
United Gas Impr.—50.	c 91½	....	....
United Lt. & Pwr. pf.—$4—no par.	l 49	44	51
United L. & P. pf.—$6.50—no par.	l 85½	81	91
United Lt. & Pwr., com., A—no par	11½	10½	28
United Lt. & Pwr., com., B—no par	k 16	13	29
Utah Pwr. & Lt., 7% pf.	l 103½	99	103½
Utica Gas & Elec., 7% pf.	104	....	....
Utica Gas & Elec., com.	*200	....	....
Utilities Pwr. & Lt., 7% pf.	92	....	....
Utilities Pwr. & Lt., com A.	29½	28½	37
Utilities Pwr. & Lt., com. B—no par	13½	13½	18½
VERMONT HYDRO - ELEC., 7% pf.	l 95½	94	96
Virginia Elec. & Pwr., 7% pf.	*105	101	105
Virginia Pwr., 7% pf.	*108	102	104
Virginian Pwr., com.	l 70	65	75
WAGNER ELEC., pf.	b 72½	61½	85
Wagner Elec., com.—no par.	b 20½	13½	34½
Washington Ry. & Elec., com.	175	....	....
Washington Ry. & Elec., pf.	88	....	....
Washington Wtr. Pwr., com.	*133	130	136
West Mo. Pwr., 7% pf.	m 92	....	....
West Penn., 7% pf.	m113½	108	115
West Penn, com.	m125	118	130
West Penn Elec., pf.	*101	95½	102½
West Penn Elec., Class A.	97½	88½	98½
West Penn Pwr., 6% pf.	£113½	108	115
West Va. Lt., Ht. & Pwr., 7% pf.	l 94½	95	98
West Va. Utilities 7% pf.—50.	l 48	43	51
Western Pwr., 7% pf.	98	91½	99
Western States Gas & Elec., 7% pf.	93	....	....
Western States Cas & Elec., com.	17	....	....
Westinghouse El. & Mfg., com—50.	70½	65	79½
Weston Elec. Instrument, Class A.	k 31	27½	32½
Weston Elec. Instrument, com.	16	13½	19½
Wheeling Elec., pf.	l 95	91	97
Wis. Pwr., Lt. & Ht., 7% pf.	l 95	85	91
Worthington Pump, pf. A.	48½	44	80
Worthington Pump, pf. B.	40½	37½	65
Worthington Pump, com.	22	19	44½
YADKIN RIVER PWR., 7% pf.	*107½	102	107½
Yale & Towne, com.—25.	72	60½	72½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Saturday, Dec. 18. lBid, low, high, Tuesday, Dec. 21. mLatest quotations available.

now place it among the largely capitalized corporations operating in the province. The capital of the corporation will now be $50,000,000. This has been made possible through the increase of the capital by the creation of 500,000 shares of 6 per cent preferred stock having a par value of $100 and of 1,999,000 shares having no nominal or par value. The company must carry on its business with funds not less than $15,000,000.

Southeastern Power Merger Ratified.—With only a small minority of stockholders opposing the move, the proposed consolidation of six Georgia power companies in the group controlled by the Southeastern Power & Light Company under the name of the Georgia Power Company was indorsed at meetings of stockholders of the constituent companies held last week. The companies involved in the consolidation are the Georgia Railway & Electric Company, the Georgia Railway & Power Company, the Athens Railway & Electric Company, the Rome Railway & Light Company, the East Georgia Power Company and the constituent Georgia Power Company.

Consumers Power Bonds Legal Investments for Savings Bank.—The Bank Commissioner of Massachusetts has announced that Consumers Power Company first lien and unifying mortgage bonds have been declared legal investments for savings banks in that state under the new law passed by the 1926 Legislature. Consumers Power Company bonds are now legal for investments of savings banks in Maine, Rhode Island, New Hampshire, Vermont and Massachusetts. There are $25,073,000 principal amount of bonds outstanding under the unifying mortgage. The $22,254,000 first lien and refunding 5 per cent gold bonds due 1936 and $3,697,000 other underlying divisional bonds outstanding are also on list of savings bank legals in Massachusetts, making a total of over $50,000,000 bonds of the Consumers Power Company system from which Massachusetts savings banks can make selection. This makes one more state that has fallen in line to modernize its laws governing the investments of savings banks. It is expected that the New York savings bank law will be amended by the next Legislature, which meets just after the first of the year, so as to broaden the present limited field for investments in bonds of public utility companies and that similar steps will be taken by other states in the future.

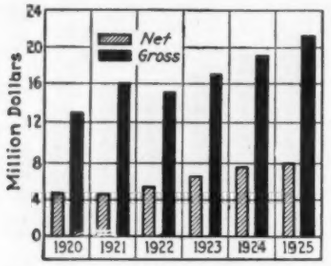
Texas Utility Increases Stock to Make Extensions.—An increase of nearly $10,000,000 in the capital stock of the Texas Power & Light Company of Dallas, which has just been made, is for the purpose of providing for important extensions to its power trans-

mission system and the probable construction of one or more additional power plants during the coming year. The amendment to the company's charter, which was filed in the Secretary of State's office, increases its capital stock to $26,500,000 from $16,600,000.

Boston Edison Advances

Analysis of Financial Structure Shows that Company Is in Excellent Condition—Earnings Up

IN AN address delivered before the Metropolitan Electrical League of Boston, Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, said: "Our investment of $100,000 in 1886 has grown to $100,000,000 in 1925. Our customers have grown from one, the Bijou Theater, to 250-odd thousand scattered throughout our entire territory, and the kilowatt-hours produced have increased steadily from the beginning until in the year 1925 the aggregate was 648,000,000." The record of



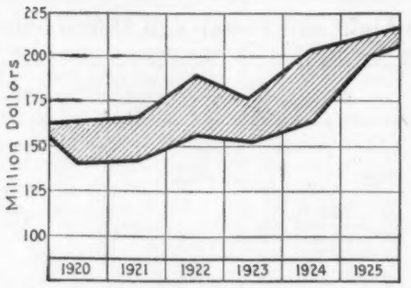
ANNUAL GROSS AND NET REVENUE OF BOSTON EDISON SINCE 1920

achievement, which this concise statement reflects is also found in an analysis of the company's financial set-up and revenue record.

Gross earnings have consistently increased from $13,920,606 in 1920, $16,162,568 the following year, $15,885,820 in 1922 and $17,877,963 in 1923, while net income has advanced from the $5,098,398 mark in 1920, $5,202,810 the following year, $5,523,679 in 1922 and $6,510,791 in 1921. A comparative statement of operations for the years 1925 and 1924 revealed that electric operating revenues advanced from $19,494,783 to $21,315,240, an increase of $1,820,457, or 9.3 per cent. Expenses increased from $9,333,351 to $9,840,877—only $507,526, or 5.4 per cent—and net before charges increased $1,312,931, or 12.9 per cent. This is an extremely satisfactory showing, especially in view of the fact that during the year the retail price of electricity was reduced from 9½ cents to 8½ cents per kilowatt-hour.

SET-UP, EARNINGS AND FINANCIAL POSITION OF EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON

1. **Financial Set-Up:**
   - Ratio debt to capitalization, 39 per cent (no long-term debt).
   - Ratio gross revenue to capitalization, 1 to 3½.
   - Ratio funded debt to gross, 2½ to 1.
   - Ratio investment to capitalization, 1½ to 1.
   - Ratio investment to gross, 5½ to 1.
2. **Revenue Record:**
   - Ratio gross to operating expenses, 2½ times.
   - Ratio revenue to total assets, 5⅝ to 1.
   - Ratio net earnings to revenue, 1 to 2⅝.
   - Times bond interest earned, 4¼ times.
   - Dividend earned, $14.35.
   - Earnings compared with whole industry—Expansion more rapid.
3. **Trust Investment Tests:**
   - Life of franchise after bond maturity—No long-term debt.
   - Percentage debt to book value of property, 24 per cent.
   - Size of gross, $21,315,241.
   - Size of net, $8,193,266.
4. **Business Progress:**
   - Ratio gross to kilowatt-hours sold—Not shown.
   - Kilowatt-hours sold per customer—Not shown.
   - Kilowatt-hours sold per customer by classes—Not shown.



HIGH AND LOW STOCK RECORD OF BOSTON EDISON COMPANY

Pacific Gas & Electric to Sell Stock to Employees.—The Pacific Gas & Electric Company has applied to the California Railroad Commission for authority to issue $1,000,000 first preferred stock and $1,000,000 common stock to employees on the partial payment plan. One share of common is to be offered at par with each share of preferred. The proceeds are to be used to reimburse the treasury for additions and betterments.

New Financing in Connection with Helena Reorganization.—The plan proposed for reorganizing the properties of the Helena Light & Railway Company, Helena, Mont., referred to in the Dec. 18 issue of the ELECTRICAL WORLD, includes the issuance of 25-year 6 per cent bonds of the new electric company to consist of all the properties which shall not be exclusively devoted to the street-railway business. The bonds are to be issued under and secured by a mortgage of the electric company constituting a first lien upon all the physical assets and franchises of the electric company then owned and thereafter acquired and also upon the stock of the railway company. The initial issue of bonds is to be $750,000, and it is to be provided that additional bonds may be authenticated under the mortgage to a principal amount not exceeding 80 per cent of the cost of additional property, extensions and (or) betterments, but only upon the filing with the trustee of certificates showing net earnings (before federal income taxes and depreciation) of the electric company equal to twice the interest upon the bonds then outstanding and the bonds then to be authenticated. Holders of certificates of deposit under the agreement dated July 30, 1925, for first mortgage sinking fund 5 per cent 20-year gold bonds of the Helena Light & Railway Company assenting to this plan will, if the plan is carried out, receive for each such thousand-dollar bond $600 in the 6 per cent bonds of the electric company and $400 in cash, together with an amount in cash equivalent to interest at the rate of 5 per cent per annum upon 60 per cent of the principal amount of the old bond from Sept. 1, 1925, to the date from which the new bonds bear interest and upon 40 per cent of the principal amount of the old bond from Sept. 1, 1925, to a date to be selected by the committee for the distribution of the new bonds and cash to the holders of the certificates of deposit.

Detroit Edison Listing.—The New York Stock Exchange has authorized the listing on or after Dec. 21 of $8,092,800 additional capital stock of the Detroit Edison Company upon official notice of issuance and sale and payment in full, making the total amount applied for to date $90,980,000. The stockholders of record Oct. 10 have been given the right to subscribe to the above stock, equal to 10 per cent of their holdings at not less than par. Proceeds from the sale of the capital stock will be applied to completion of the installation of 250,000 kw. at Trenton Channel plant and completion of buildings for its ultimate plant capacity, completion of two 120,000-volt switching stations and 21 miles of 120,000-volt transmission line, underground conduit and cable extensions in the city of Detroit, additional substations, completion of the second unit of a new steam-heating plant in the city of Detroit, and to the acquisition of property and numerous expenditures to provide for other additions to the company's present plant and equipment.

Dividends Declared

The quarterly dividends listed below have been announced by electric light and power and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Aluminum Co. of America, pf.	1¾	Jan. 1
American & Foreign Power, allot. ctf. for com. & pf., 25% pd.	.43¾	Jan. 3
Central Illinois Light, 6% pf.	$1.50	Jan. 3
Central Illinois Light, 7% pf.	$1.75	Jan. 3
Central Illinois Publ Service., pf.	$1.50	Jan,. 15
Cities Service, com.*	½	Feb. 1
Cities Service, com. †	½	Feb. 1
Cities Service, pf. and pf. B*	½	Feb. 1
Duke Power	1	Jan. 3
Empire Power, $6 pf.	$1.50	Jan. 1
Greenfield Elec. Lt. & Pwr., com.	2.50	Dec. 31
Greenfield Elec. Lt. & Pwr., em. stk.	.25	Dec. 31
Greenfield Elec. Lt. & Pwr., pf.	.38	Dec. 31
Jamaica Pub. Serv., pf.	1.75	Jau. 3
Laurentide Power	1¼	Jan. 15
Middle West Utilities, pf.	$1.75	Jan. 15
Mississippi River Power, pf.	1¼	Jan. 1
Missouri Gas & Elec. Serv., pr. ln.	$1.75	Jan. 21
Mountain States Power, pf.	$1.75	Jan. 20
New England Pwr. Assoc., com.	.37½	Jan. 15
New England Pwr. Assoc., pf.	1¼	Jan. 11
North Amer. Lt. & Pwr., pf.	1¾	Jan. 3
Northern States Pwr. (Del.), 7% pf.	1¾	Jan. 20
Northern States Pwr. (Del.), 6% pf.	1½	Jan. 20
Northern States Pwr. (Del.), com.	2	Feb. 1
Ottawa Lt., Ht. & Pwr., com.	1¼	Dec. 31
Ottawa Lt., Ht. & Pwr., pf.	1¾	Jan. 1
Pacific Gas & Elec., com.	2	Jan. 15
Panama Pwr. & Lt., pf.	1¾	Jan. 3
Public Service Elec. Pwr., pf.	$1.75	Feb. 1
Savannah Elec. & Pwr., deb. A	2	Jan. 3
Savannah Elec. & Pwr., deb. B	1¾	Jan. 3
Shawinigan Water & Power	2	Jan. 10
Southeastern Pwr. & Lt., $7 pf.	$1.75	Jan. 1
Southeastern Pwr. & Lt., ptc., pf.	$1	Jan. 1
South Calif. Edison, orig., pf.	2	Jan. 15
Southern Canada Pwr., pf.	1¼	Jan. 15
Standard Gas & Elec., 7% pr. pf.	1¾	Jan. 25
Standard Gas & Elec., com.	.75	Jan. 25
Trinidad Electric	1¼	Jan. 10
Turner Falls Pwr. & Elec., com.	$2	Dec. 31
West Kootenay Pwr. & Lt., pf.	1¾	Jan. 2
West Penn Pwr., 7% pf.	1¾	Feb. 1
West Penn Pwr., 6% pf.	1½	Feb. 1

* Monthly. † Payable in common stock.

Manufacturing and Markets

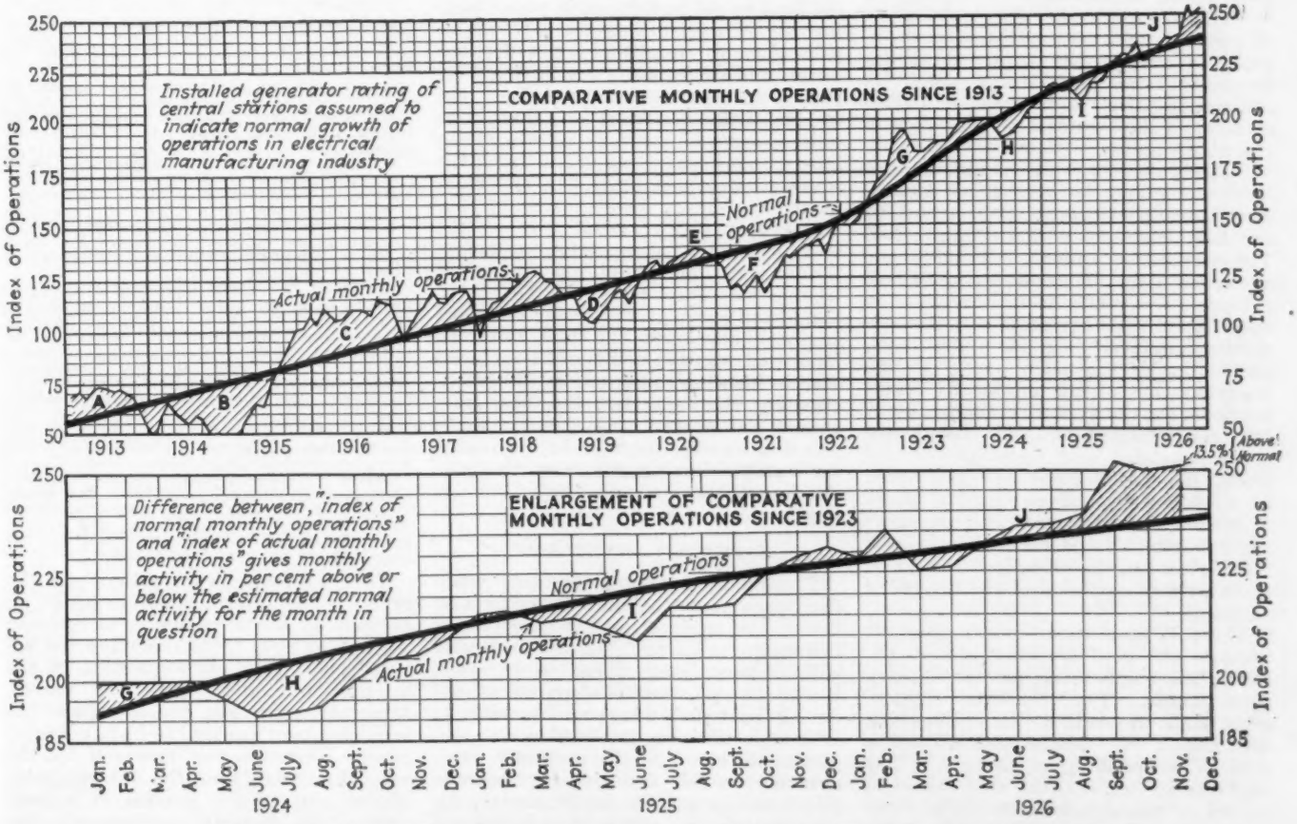
November Operations at High Rate

Electrical Manufacturing Plants Increased Their Operations by 1.7 per Cent Over Those of October—Total of 68,780,000 Kw.-Hr. Consumed During November

THE high degree of activity which prevailed in the electrical manufacturing industry during the two preceding months was continued through November, although the operations were slightly below those reported for September. Reports received by the ELECTRICAL WORLD from a large percentage of the electrical manufacturing plants of the country indicate that during November these plants consumed 68,780,000 kw.-hr. of electrical energy, as against 67,600,000 kw.-hr. in October, a gain of 1.7 per cent. A small portion of the plants, however, recorded operations under those of October. Such is the present status of operations in the electrical manufacturing plants of the nation based upon reports received by the ELECTRICAL WORLD on electrical energy consumption by a large proportion of the operating companies.

Reports received for the month of November indicate that the industry was operating at 13.5 per cent above the estimated normal for that month, as against 13.4 per cent above the estimated normal in October. The electrical manufacturing companies are operating materially above the activities reported for the first half of the year and also materially above the operations reported during the closing months of last year. A comparison of the operations during September, October and November indicates that the actual production activities during November were 1.7 per cent above those of October and 0.5 per cent above those of September.

The electrical manufacturing plants appear to have maintained, if not slightly increased, their production operations during November as compared with October, a condition which is considerably better than that reported by general industry in the country as a whole during the same month. General industry during November was operating at about 3 per cent under October, but 5.7 per cent over November of last year. Of the outstanding industries, textiles reported an increased activity during November of 9.0 per cent, iron and steel mills 4.5 per cent, leather 9.5 per cent and lumber 2.4 per cent, after correction is made for the number of working days in October and November. On the other hand, activity in the automobile industry was 11.8 per cent under that of October, and stone, clay and glass was 7.7 per cent. November activities in the non-ferrous metal-fabricating plants were about the same as during October.


COMPARATIVE MONTHLY OPERATIONS SINCE 1913
Installed generator rating of central stations assumed to indicate normal growth of operations in electrical manufacturing industry
Normal operations
Actual monthly operations
Index of Operations
ENLARGEMENT OF COMPARATIVE MONTHLY OPERATIONS SINCE 1923
Difference between "index of normal monthly operations" and "index of actual monthly operations" gives monthly activity in per cent above or below the estimated normal activity for the month in question
13.5% Above Normal
1924
1925
1926

"ELECTRICAL WORLD" BAROMETER OF ACTIVITY IN THE ELECTRICAL MANUFACTURING INDUSTRY
(Corrected for seasonal variation and referred to an average monthly normal for the year)

Plant Engineering and Purchasing

Sharply Defined Relations Cannot Exist Between Engineering and Purchasing Department

A THOROUGH understanding of the relations that should exist between the engineering and purchasing departments of an organization is essential to the interests of buyer and seller. Theoretically the functions of the engineering department in an organization are of a legislative and judicial nature while those of the purchasing department are of an executive nature. The engineering department is charged with the duty of legislating concerning the nature of the material and equipment best adapted for the particular plant, while the purchasing department is charged with the duty of executing the legislation of the engineering depart-

ment to the best advantage. The engineering department is also charged with the duty of judging whether or not its laws have been properly executed. Thus apparently each department has its well-defined duties and the trials and tribulations pertaining to these duties. The engineering department is concerned with the technical details, such as quality, performance, characteristics, operating cost, maintenance, depreciation, general adaptability for the purpose and over-all economy, while the purchasing department is concerned with the price, terms, discounts, cost of delivery, quantities to be purchased at one time for the most advantageous price, shipment and storage, etc. These duties are of a sufficiently diversified nature to warrant the maintenance of two distinct departments, even in small plants.

COMPLETE HARMONY ESSENTIAL

The necessity of perfect harmony and sincere co-operation between different departments of one organization for maximum efficiency and economy requires no exponents. It is implied in every case, frequently expressed, but too often wanting. It seems to be human nature to resent, if not resist, any encroachment on what one considers his domain. Unfortunately, there is a type of executive who is of the opinion that for maximum discipline the duties of each department must be sharply defined and that each department must "mind its own business." Such an executive is of the "military" type, forgetting that discipline for destruction is a different problem from discipline for production. Rigid discipline in an organization is responsible for enormous waste. The installation of suggestion boxes and the reward for accepted suggestions from employees throughout the plant are a result of realization that even the humblest member of an organization may have a valuable suggestion to make.

Sharply defined relations between the engineering and the purchasing departments are particularly detrimental to the best interests of an organization. The purchasing agent, although not always a man of great technical experience, frequently is in a postion to make a valuable suggestion to the designing engineer. On the other hand, the taking of too much liberty in the interpretation of the engineer's specifications, for the sake of economy, without consulting him, will frequently prove wasteful and sometimes disastrous. Good judgment and tact must be exercised by the purchasing agent in making suggestions to the engineering department, and no deviation from the engineering specifications should be made without approval of the designing engineer.

The following concrete examples illustrate the need for co-operation between the engineering and purchasing departments. The storeroom department sends an order to the engineering department "to furnish and install a modern oil-handling equipment." The engineering department undertakes a survey of the situation, makes a study of the present and near future requirements, consults the head of the storeroom department and proceeds with the design of the equipment. Information is obtained from manufacturers of such equipment, and when the design is completed the engineering department issues an order to the purchasing department to purchase the equipment and in so doing naturally specifies the equipment he is most familiar with—that is, the equipment the manufacturer of which has rendered the most information and assistance. The purchasing agent in a bureaucratic organization, having received such an order, proceeds with it, but the purchasing agent in an organization where co-operation exists tactfully asks the engineer whether the equipment he specified is the only one he thinks is best for the purpose and whether it would not be advisable to get bids from other manufacturers of similar equipment. As a result several bids and detailed specifications are received and the one most advantageous is accepted. In one particular case the equipment purchased was 40 per cent less expensive than that specified. The specified equipment possessed certain refinements which made it well worth the difference, but those refinements were of little importance in this instance.

In another case a plant was using large quantities of lime for softening the water. The cost of the lime used was about $19 a ton. It was being shipped in steel drums of about 300 lb. capacity, for which a deposit of $1 each was made. The purchasing agent conceived the idea that too much was being paid for the lime because it was being purchased from a concern specializing in water-softening supplies. He found out that he could purchase lime in the open market for about $11 a ton, and as the lime would be shipped in paper bags instead of steel drums there would be a saving of freight charges for the drums and no necessity for having $500 tied up in deposits for the drums. As, in his opinion, "lime is lime," he ordered several carloads of the cheap lime without consulting or notifying the engineering department. The new shipment was being handed out by the storekeeper in the usual way to the men who attended to water softening. Before very long an endless amount of trouble was encountered in the operation of the plant. Inquiries by the plant engineer developed the fact that the lime used was the commercial material used in building construction. Notwithstanding the fact that the lime purchased was proved by a chemical analysis and by experience to be unsuitable for water-softening purposes, the purchasing agent insisted that "lime is lime."

EFFICIENCY AND ECONOMY

There may be more efficiency when each department attends to its narrow duties, the engineering department, for instance, ordering certain material without specifying where to purchase it and the purchasing department ordering material wherever it sees fit without consulting the engineering department; but there is certainly more economy in full and sincere co-operation between the two departments. An over-all economy rather than individual efficiency will determine the real dollar-and-cent efficiency of a plant.

Union Conditions Bared

Affidavits Filed Against New York City Local Charge Bribery, Conspiracy and Corruption

CHARGES have been filed in the New York State Supreme Court by H. H. Broach, vice-president of the International Electrical Workers' Union, against seventeen officers and members of the New York City local union. A number of affidavits that are replete with details charge the seventeen officers and members with bribery, corruption and conspiracy to prevent competent mechanics from entering the union.

Some of the charges sworn to in the affidavits are as follows:

Union officers permitted electrical contractors to operate what were known as "two-way shops," employing crews of union and non-union men at the same time.

Men who knew nothing of electrical work were inducted into the union on the order of business agents. One such new member, inexperienced in the craft, was wanted in the union by a business agent "because he did the dynamiting for the McNamara Brothers and we've got to have sluggers in case the other faction starts something."

The chairman of the board which had to examine new applicants said he learned so much about the workings of the union that when he went to bed at night he "could feel the hand of the District Attorney reaching through his window." Money was offered to him "on every nook and corner" to pass applicants, and he was greeted as "a lucky Irishman," whose job was worth from $250 to $500 a week. He was told to "take the money and not be a damn fool." He refused and gladly forsook his office when the term expired.

An electrical contractor on the Fourteenth Street power house for the New York Edison Company swore that he paid Richard L. O'Hara, president of the local union, and business agent William O'Toole $200 a month each on the understanding that "things would go smoothly on the power house job." The local union voted the two men $3,500 "for expenses and expert advice on the power house situation."

A business agent took cards from union men and, for a consideration, gave them to a non-union employer who used them on union work.

Applicants for membership into the union paid money to business agents and were then "double-crossed," their money was retained and they were barred from the union.

Non-union electrical contractors were compelled to pay graft when business agents of the union kept them "on probation," sometimes for a year, before allowing them to have union mechanics.

Contractors employing union men paid business agents so that the union rules might be violated.

Many of the 2,500 men whose applications to enter the union had been on file for two or three years were secretly inducted into the union prior to April 1, when the international officers were scheduled to begin organizing the field so that employers might find available plenty of union men to supply the shortage concerning which they had been complaining for years.

Men who failed to pass the technical examination of the union's examining board were accepted after paying a local officer.

When International Vice-President Broach, at a special meeting of the union on Nov. 14 last, offered to expose the entire situation there was an uproar and almost a riot and he was not permitted by the local officers to "tear the lid off."

This Supreme Court action was the reply of the international union to an attempt by the local union to restrain the parent body from removing the accused men. The affidavits filed by the international union give the names, dates, amounts and places where the seventeen men are said to have accepted graft. Decision was reserved by the court in restraining the international officers and on the request of a local member to restrain permanently the New York officers from expending the local's money.

Business Conditions

SOME recession in business is noted in the industry, but manufacturers are very optimistic regarding the outlook. A strong demand for commercial, industrial and street-lighting equipment is reported and is reflected in a contract for $558,000 let by the city of St. Louis for street-lighting equipment and a number of orders and inquiries from other sections of the country. Industrial buying continues steady. Sales of appliances to the holiday trade give promise of exceeding those of last year by an appreciable margin. The stock dividend announced by the United States Steel Corporation last week, in view of its conservative attitude, reflects the confidence of its directors in the business outlook.

In New England lighting equipment is in especially active demand and includes industrial as well as street and commercial lighting. Industrial buying is in steady volume in the New York district, with small motors finding a ready market, but sales to central-station companies continue to be inactive. In the Southeast sales of appliances are active and industrial business is in good volume. Small motor sales in middle Georgia, especially for pumping equipment, were prominent and prospects are for considerable additional business in that line. In the St. Louis district business continues good. The city of St. Louis awarded a contract for $558,000 for the second section of its eight-million-dollar street-lighting program. Manufacturers of electrical advertising apparatus in that district report splendid progress. Industrial activity continues in the Middle West, and maintenance purchases by central-station companies are appreciably large. On the Pacific Coast sales to central-station companies and industrial plants are active and holiday business is very good.

Non-Ferrous Metal Market Inactive—Prices Steady

Copper has not been in active demand. Consumers apparently will buy only on concessions which the producers are not disposed to make. The big sellers have sufficient orders on their books to stay out of the market until the demand improves. Based on the figures for the first eleven months of this year, the world's production of copper in 1926 will exceed that of any previous year.

The American Smelting & Refining Company continues its official contract price for lead at 7.80 cents. Buyers were few, but producers, having booked much forward business, are not anxious to sell. The zinc market apparently has not been affected by the firmer tone in London and consumers show little interest. The tin market has also been inactive.

NEW YORK METAL MARKET PRICES

	Dec. 15, 1926 Cents per Pound	Dec. 22, 1926 Cents per Pound
Copper electrolytic	13.60	13.55
Lead, Am. S. & R. price	7.80	7.80
Antimony	13¼	13
Nickel, ingot	35	35
Zinc spots	7.40	7.375
Tin, Straits	69¼	67.625
Aluminum, 99 per cent.	27	27

Base copper price Dec. 22, 1926, 15¼ cents.

Industrial Buying Steady in New York District

Sales to public utility companies in the New York district continue quiet. There is some demand for poles, hardware, etc., in small lots, apparently for maintenance work, but no orders worthy of particular note are reported. Transformers, generating apparatus and switching equipment are not in active demand, and inquiries for quotations on that apparatus have also fallen off. Industrial buying is steady, small motors finding a good market, and sales of control equipment has improved.

Industrial Activity Continues in Middle West

Industrial activity continues satisfactory in the Middle West, while building in the Chicago district is considerably better than predicted. That business has been good this year is manifested by the number of dividends being declared at this time and that the Middle West section has been one of the most prosperous is readily admitted. The various utility companies are going ahead with quite a large construction program and maintenance purchases are appreciably large. A number of small items of equipment are being placed at this time, and there has been a good demand for poles, cross-arms and transformers. Jobbers appear satisfied with business this month. Those engaged in electrical appliance merchandising are at their busiest period.

Lighting Equipment Active in New England District

Electric lighting equipment is particularly active in the New England district. Sales of industrial electrical equipment are practically at a standstill, but much activity is reported in street-lighting as well as industrial-lighting equipment. A contract for a large street-lighting installation was recently placed in a central Connecticut city, and in eastern Massachusetts a number of projects are attracting attention. Included in this increasing field of sales is noted the marked interest in electric traffic guides. A recent installation, at a cost of about $40,000, was made in a central Massachusetts city, and a recent order called for 25 towers to be used on an Eastern thoroughfare. Industrial electric lighting is active, a number of large installations are reported, and several school and hospital projects will soon demand equipment. Sales of household appliances will probably exceed those of last year by an encouraging margin. A prominent distributor of appliances reports trade during the past week at about 30 per cent over the corresponding week of last year. This general trend in growth of sales volume is further substantiated by the record of a prominent group of central-station companies. This group reports an increase over last year of about 12 per cent.

Business Continues Good in St. Louis District

Business conditions in the St. Louis district continue good with slight change. The contract for the second section of the eight-million-dollar street-lighting program of the city of St. Louis has been awarded. The proposition covered the installation of 3,300 lighting units with accessory equipment and the work is to be completed in four months. The successful bid was for $558,000. One order for transformers from one of the southwest Missouri power companies is reported as amounting to over $40,000. Jobbers still are doing good steady business in all lines and reducing stock for inventory. Manufacturers of electrical advertising apparatus report splendid progress and say that the year's business will be the largest on record, with a good outlook for next year.

Sales to Industrial Plants Active on Pacific Coast

Central-station companies and industrial firms are active on the Pacific Coast. A power company requested bids on 3,000 untreated poles, and a lumber company purchased 10,000 ft. of 1¼-in. and 1½-in. conduit and 30,000 ft. of rubber-covered wire. The sale of $1,500 worth of 3-kw., 4-kw. and 5-kw. air heaters to a power company was reported, and 100 radiators and 30 waffle irons constitute a typical appliance order from the larger customers. Metal reflectors have also sold especially well. Other important power apparatus sales include one for three 1,000-kva. and three 2,000-kva. transformers, amounting to about $30,000, for installation in Salinas; an electric propelling equipment for a submarine, amounting to about $100,000; a 500-hp., 2,200-volt motor for centrifugal pump service in a Hawaiian sugar mill, six 500-kva. transformers for the Hawaiian islands and $5,000 worth of 20-hp. to 50-hp. motors. Despite these outstanding orders, sales are considered only fair.

Seattle jobbers report $15,000 worth of motors sold to a paper mill at Olympia, three 20-ton and three 10-ton mining locomotives, costing about $55,000, for use in constructing the Great Northern Railway tunnel, nine motors from 15 hp. down to a lumber mill, and several motors to a coal company. The city of Denver will open bids on Jan. 3 for machinery to pump water from the Okanogan River into the government canal. Specifications call for three units each requiring an 850-hp. motor. A paper company in Portland, plans the installation of a three-million-dollar pulp mill at Aberdeen, Wash., and it is reported that work will start early next year.

Sales of Appliances Active in the Southeast

No decrease in tne purchase of holiday electrical goods is noted in the Southeast, and prospects are that this season will be the best on record. One jobber reports $8,000 worth of business in electrical toy trains alone. Further increased activities in electrical appliance lines are foreshadowed by the opening of new retail stores in virgin territory by the larger power companies. One company has opened three such stores in the past ten days, will open three more soon after the holidays, and several others are scheduled for opening in the early part of the new year. This activity will fill a need for retail outlets for electrical merchandise in sections that have been handicapped in this particular up to the present.

Residential lighting fixture business has held up remarkably well. Commercial lighting unit sales continue to show steady increases, undoubtedly owing to aggressive campaigns on complete units by central-station companies. One company reports the sale of 425 of these units in two of its retail properties in one month. One order for a large turbine-driven blower and orders for electrical skip-hoist equipment from the Birmingham district helped to swell industrial sales totals. Small motor business in middle Georgia, especially for pumping equipment, was in prominence and prospects are for considerable additional business in this line within the next 90 days.

Activities of the Trade

Colt's Fire Arms Company Absorbs Johns-Pratt Organization

The absorption of the Johns-Pratt Company by the Colt's Patent Fire Arms Manufacturing Company was announced following a meeting of the board of directors of the latter company held on Dec. 23 at Hartford, Conn. The control of the Johns-Pratt Company has for a few years past rested in the Colt's company, and its activities were carried on as a division of the controlling organization, but now that the board of directors has taken this action, the Johns-Pratt Company will cease to function as a commercial entity.

The Johns-Pratt Company was established in Hartford in 1886. At first its main activity was the development and production of sheet packing and pump valves under the trade name "Vulcabeston," but its products have since multiplied and now include virtually every packing requirement in power plants, factories, etc., as well as electrical protective devices such as meter-service switches, fuses, service boxes and high-voltage underground equipment.

Johns-Manville Plans New Capital Structure

The stockholders of Johns-Manville, Inc., 292 Madison Avenue, New York City, will hold a special meeting on Dec. 28 to approve a plan of reorganization which calls for a readjustment of the capital structure. The company manufactures electrical insulating material, asbestos and magnesia products, fuses, fiber conduits, etc. The plan contemplates selling the total assets of the company, including the right to use its name and its franchises, to a new firm to be known as the Johns-Manville Corporation. H. E. Manville, president of the company, announcing the reorganization, explained that no change in the management of the company was contemplated.

Holders of the present no par stock of Johns-Manville, Inc., will receive for each share held three shares of no-par common and three-tenths of a share of 7 per cent cumulative $100 par preferred stock of the new corporation. In connection with the plan the directors have proposed to issue 100,000 shares of 7 per cent preferred stock and 750,000 shares of no-par common stock. Fractional shares of preferred stock will not be issued, but warrants will be issued which when combined with other fractional warrants will entitle the holder to three full shares of preferred stock. Arrangements have been made by which stockholders may sell fractional warrants at not less than $30 for three-tenths of a share. The new preferred stock will provide for cumulative dividends at the rate of 7 per cent per year, payable quarterly, and the stock will be redeemable at $120 per share plus accrued and unpaid dividends.

Siemon Company Acquires Watertown Manufacturing

The acquisition of a controlling interest in the Watertown Manufacturing Company by the Siemon Company, Bridgeport, Conn., has been announced. The Siemon Company with its subsidiaries now represents an investment of $8,000,000, and has become one of the largest molders of insulation in the United States. The Siemon Company was organized as the Siemon Hard Rubber Corporation in 1903, and ten years ago the Specialty Insulation Manufacturing Company of Hoosick Falls was acquired. Two years later control of the Colasta Company, also of Hoosick Falls, was purchased, and four years afterward the Furnaoid Company of Newark, N. J., was taken over.

Westinghouse Gets Orders for Switching Equipment

Twenty-eight truck-type panels for use in connection with the new No. 5 unit of the Crawford Avenue station of the Commonwealth Edison Company, Chicago, were recently ordered from the Westinghouse Electric & Manufacturing Company. This truck-type switching equipment will be used for the control of the motors driving the auxiliaries and also the tie circuits for supplying power to them. The Ohio Power Company, Canton, Ohio, has also ordered from the Westinghouse company 28 type CM automatic network units.

Organization Changes Announced by Miller Company

Changes in the organization of the Miller Company, Meriden, Conn., manufacturer of lighting fixtures and portable lamps, have been announced as follows: L. Wood, formerly with the Carolina Power & Light Company at Raleigh, N. C., has become a member of the sales organization of the "Duplex-a-lite" division. Mr. Wood's special effort will be in the interest of "Duplex-a-lite" central-station campaign operations. He will make his headquarters in Meriden, but will cover the entire United States in a campaign and sales promotional way. On Jan. 1 W. E. Trittipo will leave the "Ivanhoe" division of the Miller Company with headquarters in Cleveland to become district manager at Atlanta. A. H. Bruning, now in the lighting service department of the Edison Lamp Works of the General Electric Company, Harrison, N. J., will also join the organization on Jan. 1 and will become Southern representative of the "Ivanhoe" division of the company. Mr. Bruning will make his headquarters in Atlanta and will succeed Mr. Trittipo.

Copeland Products Inc., Detroit, announces that the Copeland Refrigerating Company of Pittsburgh has taken over the territory and property of the Heating & Refrigerating Company, formerly distributor in Pittsburgh for the Copeland machine. The old organization will be enlarged and the new plans include a wider distribution of Copeland products throughout Pittsburgh and the thirteen surrounding counties in Pennsylvania. The officers of the new company are: Joseph Dilworth, president; Hill Burgwin, vice-president; Eugene Hervon, secretary and general manager, and Wayland S. Bowser, treasurer.

The Memco Engineering & Manufacturing Company, Inc., 381 Hamilton Street, Long Island City, N. Y., manufacturer of high-tension transmission line and outdoor-substation equipment, announces the appointment of Ludwig Hommel & Company, 929 Penn Avenue, Pittsburgh, as its sales representative covering western Pennsylvania, eastern Ohio and the State of West Virginia. The Ludwig Hommel organization for many years has represented the Wagner Electric Corporation and the Sangamo Electric Company.

The Liberty Electric Corporation, Stamford, Conn., manufacturer of the "Liberty" valve operator and other engineering specialties, announces the appointment of Himelblau, Agazim & Company, 30 North Dearborn Street, Chicago, as its Chicago representative.

The Electric Refrigeration Corporation, Buhl Building, Detroit, announces that C. W. Matheson has been made vice-president of Kelvinator, Inc., and director of Kelvinator sales. For ten years Mr. Matheson was with the Dodge Brothers in their sales depart-

ment and from 1920 to 1922 he was sales manager and vice-president. Later he was assistant to the president of the General Motors Corporation.

The Dover Manufacturing Company, Dover, Ohio, manufacturer of electric irons and appliances, announces that it is now offering the "Bonnie Dover" electric iron—a light iron for traveling and for boudoir use.

The Edwin L. Wiegand Company, 422 First Avenue, Pittsburgh, manufacturer of electrical heating units, announces the appointment of the following representatives: Jones & Manter, 110 Broad Street, Boston; C. I. Hayes, 129 Baker Street, Providence; the Industrial Engineering & Equipment Company, 1341 Syndicate Trust Building, St. Louis, and the Harrison Sales Company, Terminal Sales Building, Seattle, Wash.

The Jalonick Appliance Company, Dallas, Tex., wholesale distributor of electrical specialties, on Jan. 1 will become an independent jobbing organization and will cover the States of Texas, Oklahoma, New Mexico, Arkansas and Louisiana. Hartwell Jalonick, president of the company, announces that already such lines as those manufactured by the Hart & Hegeman Manufacturing Company, the American Wiremold Company, the M. B. Austin Company, Edwards & Company, etc., are being handled, and the company also has the agency for Westinghouse lamps. The Jalonick company has moved into warehouse unit No. 2 of the Santa Fe Terminal at Dallas. Hollis R. Johnson, the company's new sales manager, was for eight years with the Commercial Electric Company of St. Louis and for ten years preceding was purchasing agent for Stone & Webster, at El Paso, Tex.

The W. N. Matthews Corporation, St. Louis, manufacturer of electrical specialties and mechanical painting equipment, announces that Thomas C. Clark, formerly superintendent of construction for the central overhead division of the Union Electric Light & Power Company, St. Louis, has been appointed a representative of the company, superseding W. M. Watters. Mr. Clark's territory will include Iowa, Nebraska, Kansas, Missouri, Oklahoma, Arkansas, Kentucky, Tennessee west of the Tennessee River and southwestern Illinois.

The Timken Roller Bearing Company, Canton, Ohio, announces that J. H. Ridge has been appointed branch manager of the Pittsburgh branch of the service and sales division, G. G. Weston has been made branch manager of the Omaha branch of the service and sales division, and Paul Ackerman has been appointed engineer of the service department of the company. Mr. Ackerman will have charge of all service work of the automotive, industrial and steel-mill divisions and will maintain his headquarters at Canton.

The Union Electric Company, 933 Liberty Avenue, Pittsburgh, jobber, has purchased a six-story modern warehouse building at the southwest corner of Duquesne Way and Evans Way and after alterations which are now being made will occupy the building about Jan. 1.

The Union Carbide & Carbon Corporation, 30 East Forty-second Street, New York, announces the election of W. F. Barrett as vice-president and G. W. Mead as a member of the board of directors. The Union Carbide corporation controls a number of subsidiaries, among which is the National Carbon Company.

The Bantam Electric Manufacturing Company, Inc., Bantam, Conn., has been newly organized and will engage in the manufacture of electric switches and wiring devices. The company is capitalized at $50,000, and its incorporators are James L. Doyle, George R. Trumbull, Joseph A. Cowan and F. A. Seward of Litchfield, Conn.

New Equipment Available

Mica Insulation

A synthetic resin made from phthalic anhydride and glycerine and known as "glyptal" has been developed by the General Electric Company. This product has been standardized by the company as a binder for all rigid mica insulation used in its apparatus. Glyptal-pasted mica has from 10 to 60 per cent more dielectric strength, depending on the process of production; twice the resistivity, four times the surface resistivity and only two-thirds the dielectric loss. Physically it is slightly denser, has from one and one-half to twice the transverse strength, is much more translucent and has about the same compressibility and resistance to abrasion. It show slight effect from heat, has slight tendency to carbonize and the products of decomposition do not attack copper and are non-conducting. Glyptal-pasted mica can be punched, sheared or otherwise machined as readily as shellac-pasted mica. There is no more wear upon the tools except slightly more in sawing, owing probably to the greater density and solidity of the material. In addition to rigid mica insulation glyptal can be used in the manufacture of flexible mica sheets, mica tape, etc. In addition to its uses as a binding material it is also of advantage in the manufacture of ornaments and novelties such as pen holders, pencils, etc. Its advantages in this work are permanence of color and resistance to wear.

Midget Switches

A midget safety inclosed switch and a midget motor-starting switch have been placed on the market by the Westinghouse Electric & Manufacturing Company. The inclosed switch is a two-wire, single-blade, single-fuse switch applicable to circuits of 125 volts up to 30 amp. Its over-all dimensions are only 6⅜ in. x 5⅞ in. x 3½ in. It is applicable to heavy-duty lighting circuits and on heating devices. It may also be used as a single-fused entrance switch and for starting single-phase motors on household devices up to ¼ hp. For electric refrigerators and major appliances having a thermostat in the circuit the midget switch is made with terminals for the thermostat leads. This switch is known as the midget refrigeration switch.

The midget safety motor-starting switch, known as the type WK-11, occupies little space and yet provides protection to the motor both while starting and running. This switch is designed for starting single-phase motors up to ¼ hp. and is provided with a plug-type thermal cut-out. It is of the inclosed, externally-operated, two-wire, single-blade type and has a capacity of 30 amp. at 125 volts. All these switches are designed for advantageous installation and wiring.

Floodlighting Projector

A new 24-in. diameter "Golden Glow" floodlighting projector has been placed on the market by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia. This new projector is known as the type FLA-2430 and is to meet service conditions such as are imposed by the longer railway yards where space for tower location is available only at either end of the area to be floodlighted. This new unit projects a long-range beam of high intensity. The projector case is made of a cast aluminum alloy, approximately ⅛ in. thick, and the unit is equipped with a hinged rear door made of the same material and in which a 24-in. diameter "Golden Glow" or crystal mirror glass reflector is flexibly mounted.

The front of the light is regularly equipped with a molded convex lens made of special heat-resisting and annealed glass, approximately ¼ in. thick. The lens is also held in position by flexible retaining clamps. The focusing device is of the universal type, permitting adjustment in both the vertical and horizontal planes. This focusing device is mounted at the top for use with PS-52 floodlighting lamps or at the bottom for use with G-40 lamps, where a highly concentrated beam is desired. The entire case forms an absolutely weatherproof inclosure and is of the non-ventilated type. The entire unit is mounted on a swivel trunion allowing for directing the beam of light in any direction and with provision for locking firmly in position.

Motor-Starting Switches.—Two additions to its line of tumbler-type motor-starting switches have been made by the Trumbull Electric Manufacturing Company, Plainville, Conn. The No. 2361 meets the demand for a small three-pole tumbler switch for use with polyphase motors. It is rated 30 amp. at 250 volts and can be used with 2-hp., three-phase, 600-volt motors. The switch is housed in a black-enameled box of the surface type. The No. 3221 is a two-pole switch of the flush type rated 20 amp. at 250 volts. It is built to fit any standard outlet box and is provided with a steel guard which protects the operating lever.

New Trade Literature

CONTROL SYSTEM FOR DIRECT-CURRENT MOTORS.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-451 covering its "MT" (mill-type) control system for direc-current motors for use in connection with motors driving steel-mill auxiliaries, control of crane bridge, trolley and hoist motors, coal and ore bridges, etc. This bulletin also contains facsimiles of oscillograms taken under actual service conditions.

FIREBRICK CEMENT.—A bulletin distributed by the Botfield Refractories Company, Swanson and Clymer Streets, Philadelphia, calls attention to the uses of its "Adamant" fire brick cement. A few suggestions for longer service from firebrick is included.

REACTORS.—Leaflet L-20299 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates its type "NR" subway mounting reactor for use in alternating-current network systems. The approximate outline dimensions in inches and connection diagrams are included.

ELECTRIC STOVES. — Bulletin A-132 issued by the Standard Electric Stove Company, Toledo, Ohio, describes its line of six shelf-type electric ranges, which recently have been developed.

INSULATED WIRES AND CABLES.—A catalog describing the Rome insulated electrical wires and cables from copper bar to finished copper wire has been issued by the Rome Wire Company, Rome, N. Y. The catalog contains the company's standard for soft annealed bare copper wire, and includes specifications for its various types of insulated wires and cables as well as a complete set of tables which furnish detailed data. A section is devoted to lamp and flexible cords, including "Romex" cable. A short history of wire gages and measurement and gage data, supplemented by several tables including a chart for calculating wiring circuits, wiring data for motors, conduit sizes for wires and cables, etc., are also given in the catalog.

Foreign Trade Opportunities

DIESEL ELECTRIC LOCOMOTIVES FOR BUENOS AIRES, ARGENTINA.—Bids will be received by the Director General of Navigation of the port of Buenos Aires, Argentina, until Feb. 24, 1927, for three Diesel electric locomotives. Specifications have been mailed to the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., and will be available to American firms when received.

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number

Purchase and agency is desired in Stuttgart, Germany (No. 23,318), for electric milking machines.

An agency is desired in Leipzig, Germany (No. 23,261), for automobile accessories, especially lighting systems and ball bearings.

An agency is desired in Alexandria, Egypt (No. 23,258), for magnetos, switches and wiring.

An agency is desired in St. John, New Brunswick (No. 23,263), for electrical household devices; also for electrical household appliances (No. 23,264).

Purchase is desired in Wellington, New Zealand (No. 23,317), of electric laundry equipment, lighting and wiring fixtures for apartments, electric refrigerators, telephone systems for apartment houses, and freight and passenger elevators.

Purchase is desired in Saigon, Indo-China (No. 23,313), of electric miners' head lamps.

An agency is desired in Patras, Greece (No. 23,341), for alternating-current motors; also for electric refrigerators (No. 23,323).

An agency is desired in Montreal, Canada (No. 23,324), for power-house devices and controls.

Purchase and agency is desired in Milan, Italy (No. 23,333), for radio sets and parts.

An agency is desired in Sydney, Australia (No. 23,285), for electric railway supplies.

An agency is desired in Melbourne, Australia (No. 23,262), for electric washing machines, refrigerators and wiring supplies.

Purchase is desired in Pernambuco, Brazil (No. 23,295), of cotton mill machinery, to be operated by electricity.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

FALL RIVER, MASS.—The Directors of the Montaup Electric Company have authorized the installation of a 35,000-kw. turbine generator and additional boiler capacity, to cost about $4,000,000. Contract for the proposed extension has been awarded to Stone & Webster, Inc., 147 Milk Street, Boston.

KINGSTON, R. I. — Plans are under consideration for extensions to the power plant at the Rhode Island State College, to cost about $40,000.

MILTON, VT.—The Public Electric Light Company, St. Albans, is planning to build a hydro-electric plant on the Lamoille River, near Milton, to develop 4,000 hp.

Middle Atlantic States

ANDOVER, N. Y.—The Public Service Commission has approved the petition of the Niagara, Lockport & Ontario Power Company, Buffalo, for permission to make extensions to its system in Andover, under the terms of a franchise granted by the Town Board.

BATAVIA, N. Y. — The Western New York Utilities Company has been authorized to make extensions to its system in the towns of Clarkson, Covington and Middlebury, and to exercise franchises granted the company by the Town Boards.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies & Accounts, Navy Department, Washington, until Dec. 28, for 175 automatic telephones, and automatic telephone system and test stand. (Schedule 6391.)

BUFFALO, N. Y. — The Moffat Flour Mills, Inc., 1025 Seneca Street, plans to install electric power equipment in its proposed grain elevator, to be erected at Second Street and the Pennsylvania Railroad, to cost about $400,000.

FORT H. G. WRIGHT, N. Y.—Bids will be received by the Signal Corps Sound Laboratory, Fort H. G. Wright, until Jan. 15, for 9,000 ft. of submarine cable. (Circular 3.)

MACEDON, N. Y.—Permission has been granted the Rochester (N. Y.) Gas & Electric Company to extend its system to serve a portion of the town of Macedon. The company plans to extend its transmission line from Penfield.

MALONE, N. Y. — Authority has been granted the Malone Light & Power Company to extend its electric system in Bombay. The company plans to erect a transmission line from Helena to Hogansburgh to supply electricity to residents in that district.

OSWEGO, N. Y.—Plans for the proposed local paper and paper bag mill, of the Taggart Brothers Company, Watertown, to cost about $1,500,000, include a power house.

POUGHKEEPSIE, N. Y. — The Central Hudson Gas & Electric Corporation, recently organized to take over a number of utility companies, operating in Greene, Ulster, Albany, Columbia and Putnam Counties, plans extensions in transmission lines for connection between a number of systems.

ROCHESTER, N. Y.—The installation of a new lighting system on North, Franklin, Andrews and Ormond Streets and University Avenue is under consideration by the Central Improvement Organization. Street-lighting service is furnished by the Rochester Gas & Electric Company.

SYRACUSE, N. Y.—An agreement has been entered into between the city of Syracuse and the Syracuse Lighting Company, whereby all of the arc lamps now in use will be replaced with 250-cp. lamps of the newest type.

TARRYTOWN, N. Y. — The Chevrolet Motor Company, Detroit, a division of the General Motors Corporation, plans to install electric power equipment in proposed additions to its local assembling plant, to cost about $3,000,000.

WOLCOTT, N. Y.—Permission has been granted the Northern Wayne Electric Light & Power Company to extend its transmission lines into the towns of Butler and Savannah. The company plans to furnish electricity to the hamlet of South Butler and to residents along the transmission line and to make connection with the transmission line of the Niagara, Lockport & Ontario Power Company at Savannah.

HOLLAND, N. J.—Plans are under way by the General Gas & Electric Corporation, 50 Pine Street, New York City, for the construction of a 200,000-hp. steam-driven electric plant at Holland to supply power for its interconnected system.

NEWARK, N. J.—An electric generating station and an ice-manufacturing and refrigerating plant will be installed in the proposed addition to the department store of L. Bamberger & Company, Market and Halsey Streets. The entire cost is estimated at $10,000,000. Jarvis Hunt is architect, and Martin C. Schwab, Chicago, consulting engineer, both of Chicago.

LONGPORT, N. J.—The Borough Commissioners are considering the extension of the Ventnor Avenue lighting system throughout a greater portion of the borough.

CONSHOHOCKEN, PA. — The Alan Wood Iron & Steel Company plans to replace all steam-driven equipment with electric-operated machinery in its East Mill.

FORD CITY, PA.—The Pittsburgh Plate Glass Company, Frick Building, Pittsburgh, has started work on the electrification of Department No. 5, at its local sheet glass plant, and will eventually equip other divisions with electrically operated machinery.

OIL CITY, PA.—The Pennzoil Company, Oil City, is considering the installation of a power plant in connection with proposed extensions at its local refining plant. The entire cost is estimated at $500,000.

PITTSBURGH, PA.—The Keystone Sand & Supply Company, 302 Penn Avenue, Pittsburgh, plans to install electric power equipment in its proposed storage and distributing plant in the Southside section, to cost about $250,000.

ROCK HALL, MD.—Arrangements have been made by the officials of the Chesterton (Md.) Electric Light & Power Company and the Town Council, whereby the former is to supply electricity for the town and the municipal electric plant closed down. Under the terms of the contract the company is to extend the service to Fairlee, Edesville and furnish electricity to residents along the line.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Jan. 4, for a quantity of storage batteries and spares for eastern and western yards (Schedule 6369).

WASHINGTON. D. C.—Bids will be received by the Marine Corps, Washington, until Jan. 4, for a quantity of porcelain insulators, fuses and other electrical supplies. (Schedule 336.)

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until Jan. 11, for one electric generating plant, motors, steel conduit, and other electrical supplies. (Panama Circular 1775.)

North Central States

TOLEDO, OHIO—Plans for the proposed local oil storage and distributing plant of the Roxana Petroleum Corporation, Arcade Building, St. Louis, to cost about $1,500,000, include a power plant.

LOUISVILLE, KY. — Bids will be received at the office of the United States Engineer, Louisville, until Jan. 3, 1927, for furnishing operating machinery for Locks Nos. 47, 50, 51, 52 and 53, Ohio River.

EVANSVILLE, IND. — The Board of School Trustees plans to install an electric power and shop division in the proposed vocational high school building at the central high school, to cost about $160,000.

WHITING, IND.—Bids are being asked by the Standard Oil Company of Indiana for a steam turbine power plant, to cost about $1,000,000. R. E. Humphrey, Whiting, is engineer.

CHICAGO, ILL.—Bids will soon be asked by the Sanitary District of Chicago, 910 South Michigan Avenue, for construction of pumping station for West Side sewage treatment works. The cost is estimated at $1,500,000.

LA GRANGE, ILL.—Plans are being considered for installing an ornamental lighting system on various streets. The Hancock Engineering Company, 2047 Ogden Avenue, Chicago, is engineer.

FLINT, MICH.—The E. I. du Pont de Nemours Company, Wilmington, Del., plans to install electric power equipment in proposed additions to its local plant, to cost about $400,000.

MILWAUKEE, WIS.—The annual budget of the Wisconsin Telephone Company provides for an expenditure of $6,725,000 during the coming year, of which about $2,125,000 will be spent in Milwaukee. The major expenditures will include $505,000 for land and buildings; $1,825,000 for central office equipment; $1,200,000 for telephone station equipment; $2,145,000 for telephone exchange lines, and $1,050,000 for long-distance lines.

HARDY, IOWA.—The citizens have voted to sell the municipal electric distribution system to the Central Iowa Power & Light Company, Waterloo. The company will also take over the 10-mile transmission line between Hardy and Thor.

CAPE GIRARDEAU, MO.—The installation of electric lamps in the Red Star, Smelterville and Koch suburbs have been authorized by the City Council.

PIEDMONT, MO.—Preliminary work will soon begin under the control of the Black River Hydro-Electric Company on the proposed hydro-electric plant on the Black River, near Piedmont. W. H. Meredith, Poplar Bluffs, has been granted a permit by the Federal Power Commission for the project. The plans call for a dam 135 ft. high and 1,500 ft. long, and a plant to develop about 13,500 hp. to cost about $4,000,000.

PURDY, MO.—At an election held recently the proposal to sell the municipal electric distribution and transmission system to the Ozark Power & Water Company, Ozark Beach, was carried. The company was also granted a twenty-five year franchise to operate in Purdy.

ROLLA, MO.—Preliminary plans are being prepared for a fuel and power house, at the Missouri School of Mines and Metallurgy, to cost about $58,000.

ST. LOUIS, MO.—The contract for the second section of the $8,000,000 street-lighting program, including districts B and C, has been awarded by the Board of Public Service to A. M. Ryckoff, contractor. The equipment will be furnished by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The contract involves an expenditure of $650,000 and calls for the installation of nearly 3,300 lighting units.

LA MOURE, N. D.—The City Council is considering the installation of an improved lighting system in the business district.

Southern States

GREENSBORO, N. C.—The North Carolina Public Service Company contemplates extending its transmission lines into rural districts and to McLeansville, a distance of about 8 miles.

HENDERSON, N. C.—Bids will be received by the City of Henderson until Jan. 12, 1927, for water works improvements, including a complete water purification works, consisting of subsidence basins, filters, with all filter equipment and piping, clear water basin, building, filter housing, pump room, storage, etc., pumping equipment and electric control equipment for same. William C. Olsen, Inc., Raleigh, is consulting engineer.

EDISON, GA.—The Baker County Power Company, Newton, which has acquired the municipal electric plant, has been granted a franchise to operate here.

FOLKSTON, GA.—The City Council is considering a proposal submitted by G. C. Henry, Ortega Boulevard, and Howard P. Morris, 118 Cherry Street, Jacksonville, for the purchase of the local electric light plant. If taken improvement will be made to the plant and an ice plant will be installed.

LAKELAND, GA.—The City Council is considering the installation of an electric light and power plant.

WAYCROSS, GA.—The erection of a transmission line from Screven to Jesup is under consideration by the Ware County Light & Power Company.

RICHMOND, VA.—Philip Morris & Company, Ltd., 44 West Eighteenth Street, New York, plans to install electric power equipment in its proposed local cigarette manufacturing plant to cost about $400,000.

FERNANDINA, FLA. — The Pinellas County Power Company, St. Petersburg, is considering extending its service to Fernandina.

MIAMI, FLA.—The Florida East Coast Utilities, Inc., Johnson & Moffatt Building, plan to install an ice-manufacturing and cold storage plant, to cost about $1,000,000. Ophuls & Hill, Inc., 112 West Forty-second Street, New York, is engineer.

JOHNSON CITY, TENN.—Work will soon begin by the Tennessee Eastern Electric Company on an addition to its plant on the Wautauga River plant, 3 miles from Johnson City, to cost about $250,000. The equipment will include a 5,000-kw. generating unit.

MARTIN, TENN.—Plans are being prepared by the Martin Ice & Coal Company for a new ice-manufacturing plant, to cost about $60,000.

UNION CITY, TENN.—J. P. Minck of Minck & Olaison, Tulsa, Okla., engineers, have submitted a proposal to the City Council for the purchase of the municipal electric light and power plant.

FOLEY, ALA.—The Foley Light & Power Company contemplates extending its electric service to Magnolia Springs.

McGEHEE, ARK. — Improvements and extensions are contemplated by the Arkansas Power & Light Company, Pine Bluff, to its local system, involving an expenditure of $175,000, of which $100,000 will be used for the electric system.

MENA, ARK.—The Southwestern Gas & Electric Company, Texarkana, is considering plans for extensions and improvements in its electric lighting sysytem and transmission lines in this section, to cost about $20,000.

BATESVILLE, ARK.—Plans for the proposed local plant of the Missouri Portland Cement Company, Post Dispatch Building, St. Louis, include a power house. The cost of the entire project is estimated at $1,000,000.

CAMDEN, ARK.—The Arkansas Fiber & Paper Company, operated by the International Paper Company, 100 East Forty-second Street, New York, plans to install electric power equipment in its proposed local mill, to cost about $5,000,000. Electric service will be furnished by the Arkansas Power & Light Company.

TEXARKANA, ARK.—The City Council is considering extensions and improvements to the street-lighting system in the downtown section.

JACKSON, LA.—Bids, it is understood, will soon be asked by Davis Stewart, Natchez, Miss., for construction of waterworks system and installation of an electric lighting plant, equipped with a 200-kw. generating unit, etc. The cost is estimated at $400,000.

MONROE, LA.—At an election to be held Jan. 18, 1927, the proposal to issue $600,000 in bonds for improvements to waterworks, including dam, pumping equipment, etc., will be submitted to the voters. W. T. Neal is engineer.

RAYVILLE, LA.—Plans are under consideration by the Town Council for extensions to the municipal electric light plant.

GUYMON, OKLA.—Arrangements have been made between the City Council and the Inland Utilities Company, whereby the company will take over the municipal electric plant. The proposal will be submitted to the voters at an election to be held Jan. 11, 1927.

SAND SPRINGS, OKLA.—The erection of a 33,000-volt transmission line, 11 miles long, from Shidler to Kaw City, is under consideration by the Sand Springs Power, Light & Water Company, to cost about $40,000. C. H. Tingley, Sand Springs, is engineer.

DALLAS, TEX.—The Texas Public Public Utilities Company is not interested in the hydro-electric development on the Colorado River in Texas at Bluffton as reported in the issue of Dec. 18.

EL PASO, TEX.—The Mountain States Telephone & Telegraph Company has appropriated $2,500,000 for extensions to its system, including cable lines, instruments, etc., in El Paso territory in Texas and New Mexico. The fund is to be expended over a period of four years.

McLEAN, TEX.—The Southwestern Public Service Company, Carlsbar, N. M., which has acquired the municipal electric plant, contemplates extensions in transmission lines in this section.

Pacific and Mountain States

MODESTO, CAL.—The Modesto Ice Delivery Company plans to build a new ice-manufacturing plant, to cost about $100,000.

LOS ANGELES, CAL.—The City Council has passed an ordinance for the proposed Casitas Silverlake lighting district, to include the installation of improved lighting systems on Casitas, Laclede, Atwater, Larga, Madera, Garden and Glenhurst Avenues, Tyburn and Garcia Streets, and Silverlake Boulevard.

LOS ANGELES, CAL.—The Goodyear Tire & Rubber Company, Akron, Ohio, plans to install electric power equipment in the proposed addition to its local mill at Central Avenue and Sixty-seventh Street, to cost about $250,000.

LOS ANGELES, CAL.—Sears, Roebuck & Company, Arthington and Homan Avenues, plans to install electric power equipment in their proposed factory and distributing branch on East Ninth Street, to cost about $4,000,000. Martin C. Schwab, Chicago, is engineer, in charge of electrical and mechanical installation.

SAN FRANCISCO, CAL.—Bids will be received by the United States Engineer until Jan. 5, for one electric motor with controlling appliances for booster pump.

SAN GABRIEL, CAL.—Steps have been taken by property owners on Mission Drive for the installation of an ornamental lighting system on that thoroughfare. A. J. Cuneo, is interested in the project.

TULARE, CAL.—The City Council is planning the installation of an ornamental lighting system on L Street, between King and Inyo Streets.

TURLOCK, CAL.—Bonds to the amount of $600,000 have been approved by the Turlock Irrigation District, for the installation of two additional generating units at the Don Pedro hydro-electric power plant at Don Pedro, and for additional equipment at the Turlock substation.

BOISE, IDAHO—Plans are being considered by the Idaho Power Company for extending its transmission line from Buhl to Castleford, and from Castlewood to Fairview, making a 30-mile circuit.

DENVER, COL.—Early next spring the Public Service Company of Colorado plans to extend its 66,000-volt transmission line from Brush into the Beaver Valley, a distance of 13 miles, to supply electricity for operating pumps, etc.

LOVELAND, COLO.—The United States Gypsum Company, 205 West Monroe Street, Chicago, plans to install electric power equipment in the proposed addition to its local plaster mill, to cost about $300,000.

Canada

ST. JOHN, N. B.—Investigations are being made by the New Brunswick Electric Power Commission on what is known as the Meductic power site on the St. John River, 38 miles from Fredericton, where it is estimated that between 50,000 hp. and 60,000 hp. could be developed.

ST. JOHN, N. B.—The New Brunswick Electric Power Commission plans to extend the Hydro transmission line from Point du Chene to Barachois, a distance of 4.6 miles, this winter. Two extensions are contemplated in the spring, one from Sussex Corner to Penobsquis, and the other from Salisbury to Colpitts.

LAKEFIELD, ONT.—The Canada Cement Company, Ltd., Phillips Square, Montreal, plans to install electric power equipment in its proposed local mill, to cost about $750,000.

QUEBEC, QUE.—Plans are under consideration to install new automatic traffic signals on various streets, to cost about $50,000. J. A. Tremblay is engineer.

THREE RIVERS, QUE. — The Canada Iron Foundries, Ltd., plans to install electric power equipment in the proposed addition to its plants, to cost about $500,000.

CAP ROUGE, QUE. — The St. Regis Paper Company, 100 East Forty-second Street, New York, plans to install electric power equipment in its proposed local mill, to cost about $750,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 16, 1926)

1,607,304. STORAGE-BATTERY PLATE; C. C. Rich, Mount Vernon, N. Y. App. filed June 20, 1923.

1,607,313. INDICATING PLUG FUSE FOR ELECTRIC CIRCUITS; F. J. Schordene, Patchogue, N. Y. App. filed Feb. 2, 1926.

1,607,385. TIME CONTROLLER FOR ELECTRIC CIRCUITS; E. M. Benham, Norwood, Ohio. App. filed April 26, 1922. For electric time clocks or burglar-alarm systems.

1,607,393. ELECTRIC LIQUID-HEATING APPARATUS; J. H. Derby, New York, N. Y. App. filed Jan. 9, 1925. Heating device which may be attached, for example, to water piping in place of the usual faucet and which may have its heating element or elements plugged into the usual electric outlet without special provision in the way of wiring or fuses, and which when thus connected will supply, upon demand, water heated to the desired temperature and in sufficient quantities for ordinary use.

1,607,413. LIGHTING UNIT; E. D. Tillson, Evanston, Ill. App. filed Jan. 2, 1925. Semi-indirect fixture.

1,607,424. BUSHING INSULATOR TERMINAL; A. O. Austin, Barberton, Ohio. App. filed Aug. 2, 1922.

1,607,425. METHOD AND APPARATUS FOR TESTING INSULATORS; A. O. Austin, Barberton, Ohio. App. filed March 1, 1923.

1,607,432. ELECTRIC CABLE; S. J. Bryce, Leigh, England. App. filed Dec. 11, 1925. The individual conductors or cores of a multicore electric cable are associated with a strip or tape of paper, cloth or the like which has one or a group of punchings, perforations or mutilations in it spaced along it, the punchings differing for each core or conductor. This strip or tape of paper, linen or the like material may either lie along each core or be helically wrapped upon it.

1,607,433. ELECTRIC ARC-LAMP; T. L. Carbone, Berlin, Germany. App. filed July 26, 1921. (Granted under the provisions of the act of March 3, 1921.) To provide in arc lamps for storing in close proximity to the voltaic arc the heat emanating from the latter and to make use of such heat for the purpose of increasing the illuminating power of the gases of said voltaic arc and of attaining a perfect consumption.

1,607,436. TERMINAL HOUSING; P. I. Chandeysson, St. Louis, Mo. App. filed July 14, 1923. Whereby connection between an electric motor, generator or other device and an electric conduit may be easily and quickly made.

1,607,439. ELECTRIC WALL PLUG AND LIKE FITTING; H. W. Clothier, Walls-end-on-Tyne, England, and H. F. Secretan, Pelaw-on-Tyne, England. App. filed April 21, 1925.

1,607,460. DRY-CELL BATTERY; H. W. Jones, Cleveland, Ohio. App. filed May 4, 1922.

1,607,464. FLOAT-OPERATED CIRCUIT CLOSER; W. H. Kirby, Beverly, Mass. App. filed Nov. 18, 1924.

1,607,496. SEPARATOR FOR STORAGE-BATTERY ELECTRODES; J. P. Wilburn, Indianapolis, Ind. App. filed Feb. 1, 1923.

1,607,509. ELECTRIC WATER HEATER; C. P. Boucher and F. J. Cid, Indianapolis, Ind. App. filed Sept. 1, 1923. In which a circulation takes places in the annular space between two concentric tubes.

1,607,515. INCANDESCENT PROJECTING LAMP; Ridgewood, N. J. App. filed June 30, 1921.

1,607,526. PHASE METER; R. M. Gilson, Pittsburgh, Pa. App. filed Oct. 24, 1923.

1,607,549, 1,607,550, 1,607,551. MERCURY SWITCH; R. D. Mailey, East Orange, N. J. Apps. filed Oct. 27, 1923, May 26, 1924, and Dec. 17, 1924. In which provision is made for the automatic opening thereof at normal or at excessive temperatures. Applicable to electric irons, etc.

1,607,562. SAFETY LAMP; H. S. Potter, Johannesburg, South Africa. App. filed April 26, 1923. Suitable for giving highly effective illumination with the maximum safety in the underground workings of mines, inside boilers, tanks, etc.

1,607,567. DRY BATTERY; H. Shimidzu, Yotsuya-Ku, Tokyo-Shi, Japan. App. filed Jan. 28, 1926.

1,607,582. METHOD OF MAKING ELECTRIC SWITCHES; W. R. Walker, New Dorp, N. Y. App. filed Nov. 10, 1923. Mercury electric switches and the like. The sealing in of metal electrode terminals in such switches and the preparation of such terminals for actual use and operation.

(Issued Nov. 23, 1926)

1,607,606. PRESSURE-RESPONSIVE MAKE-AND-BREAK DEVICE; W. F. Clark, Cleveland, Ohio. App. filed May 3, 1919.

1,607,632. ELECTRIC SWITCH; O. Kupferman, Brooklyn, N. Y. App. filed Oct. 23, 1925. Canopy switch.

1,607,668. CARRIER TRANSMISSION OVER POWER CIRCUITS; C. H. Fetter, Milburn, N. J. App. filed April 29, 1924. In a system for signaling over power conductors, a power source, power conductors for transmitting power from said source to a load, carrier apparatus, means for coupling said carrier apparatus to said power conductors comprising condensers so designed mechanically as to withstand high power voltages, and means to neutralize in part the reactance of said condensers at carrier frequencies so that the impedance looking into the carrier channel may be made substantially the same as the impedance looking into the power network.

1,607,675. APPARATUS FOR HEATING COILED STOCK; E. S. Jeffries, Hamilton, Ontario, Canada. App. filed Aug. 9, 1923. By the passage of an electric current therethrough.

1,607,710. ELECTRODE; E. J. von Henke, Chicago, Ill. App. filed Feb. 28, 1923. Water-cooled electrode for electric spot-welding machines.

1,607,712. ELECTRICAL CONNECTING AND SUPPORTING DEVICE; E. C. White, New York, N. Y. App. filed March 5, 1920. For supporting an electrical appliance to a wall or ceiling and connecting it electrically with a source of current.

1,607,721. THERAPEUTIC GLOBE; H. C. Burrus and G. A. Torrence, Hot Springs, Va. App. filed Feb. 20, 1926.

1,607,737, 1,607,738. INCLOSED SWITCH; B. E. Getchell, Plainville, Conn. App. filed April 26, 1920, and June 24, 1921. Designed so as normally to lock the switch in its open circuit position when the cover is open, to lock the cover closed when the switch is in the on or closed circuit position, and to permit the cover to be opened by inspectors or other authorized individuals without opening the circuit.

1,607,757. AUTOMATIC CONTROL DEVICE FOR IRONS; G. D. Jordan, Cleveland, Ohio, and C. A. Braden, Lakewood, Ohio. App. filed June 25, 1923.

1,607,759. ELECTRODE FOR BATTERIES; F. A. Keller, New York, N. Y. App. filed March 17, 1925. Positive electrode for use in dry or semi-dry battery cells particularly.

1,607,799. CIRCUIT CLOSER; H. J. Munster, San Diego, Cal. App. filed July 25, 1925. For film exhaustion signals of motion-picture machines.

1,607,800. THERMALLY ACTUATED ELECTRIC SWITCH; E. G. Nicholson, Horsell, Woking, England. App. filed April 12, 1926. For preventing overheating of electric heating apparatus of the kind in which spring mechanism tending to open the switch is normally held out of operation by fusible alloy or solder which melts or softens when a certain predetermined temperature is reached.

1,607,823. TESTING INCANDESCENT LAMPS AND OTHER EVACUATED VESSELS; D. S. Gustin, Newark, N. J. App. filed March 29, 1922. A method for testing the degree of vacuum.

1,607,836. CENTRIFUGAL SWITCH; C. R. Martin, Milwaukee, Wis. App. filed April 17, 1922. A centrifugal-switch mechanism including a plurality of snap switches which are operable at different speeds. A mechanism in which it is possible to predetermine adjustably the speed at which the switches will operate.

1,607,850. PLATING MACHINE; W. F. Service, New Britain, Conn. App. filed May 2, 1925. Comprises the combination of a conveyor structure for carrying the work and a set of vats or tanks for cleansing water and solutions for cleaning and the actual plating, and also having means for delivering the goods from the conveyor.

1,607,868. AUTOMATIC SWITCH FOR DISTANT CONTROL (Granted under the provisions of the act of March 3, 1921); L. L. Chauveau, Paris, France. App. filed April 28, 1920. An automatic-switch-operating system based on the application of known elements to a new combination which permits the conditions fundamental for the good operation of the system to be fulfilled.

1,607,908. BATTERY HOLDER; M. A. Nelson, Moorhead, Minn. App. filed April 30, 1926. Holders for storage batteries during their manipulation, as when the plates are to be removed from the jars or when the jars are to be removed from the case.

1,607,917. ELECTRIC INDICATING AND SIGNALING SYSTEM; S. H. Rowland and C. E. Paine, Bath, Me. App. filed Oct. 26, 1923. For transmitting signals or indications as embodied in a ship's telegraph, for which it is particularly well adapted, though not limited to such use.

1,607,920. STORAGE-BATTERY ELEMENT; J. Sato, Highland Park, Mich. App. filed April 4, 1924. To provide compositions for the positive and negative plates which will adhere firmly to the supporting grids at a higher degree of acidity than is feasible with compositions at present used, whereby the strength of the electrolyte used while charging may be less than that now customarily used.

1,607,948. THERMOSTATIC ALARM DEVICE; J. Grabowski, Pawtucket, R. I. App. filed Nov. 6, 1924. To give an alarm in the event of fire or in the event of the temperature rising to a point threatening danger of fire.

1,607,960. METHOD AND MEANS FOR ELECTRODEPOSITING NICKEL METALS AND THE RESULTING PRODUCTS; C. P. Madsen, New York, N. Y. App. filed June 26, 1923.

1,607,994. MEANS FOR ELECTRODEPOSITING METALS; C. P. Madsen, New York., N. Y. App. filed Aug. 4, 1921.

1,608,011. CABLE CONNECTOR; G. C. Thomas, Jr., Elizabeth, N. J. App. filed Jan. 22, 1924. For joining electric cables to outlet-box fixtures.

1,608,029. INSULATOR; F. M. Locke, Victor, N. Y. App. filed Aug. 1920. Suspension insulator which has the insulating member free from the strains or stresses of suspension so that it will be subject only to electrical stresses or strains. To provide for connecting the terminals such as the strain pin and the suspending means so that a maximum electrical distance between these terminals is obtained; to connect the terminals to an insulating member in such a manner that the member is placed under compression by the strain on the insulator and not under tension; to provide an insulator element formed of two insulating members, one of which carries the mechanical strain while the other carries the greatest electrical strain and is substantially free from mechanical strain, so that the electrical strain is more evenly distributed over the surface of the insulator than has heretofore been possible, causing less corona effect; to provide an insulator which is not subject to a high electrical flashover but will spill over at about its wet flashover voltage.

1,608,061, 1,608,062, 1,608,063. WIRE HANGER; A. J. Gurney, Canton, Ohio. Apps. filed Jan. 13, 1925. Hanger for trolley wire or the like.

1,608,066. ELECTRIC IGNITER FOR STOVES; A. E. Hoy, Denver, Col. App. filed Jan. 30, 1926.

1,608,070. ELECTRIC SWITCH; H. E. Leppert, New Britain, Conn. App. filed Jan. 14, 1926. Adapted to be used in panelboard construction. Toggle type.

1,608,094. AUTOMATIC SCHEDULE REGULATOR FOR DISPATCHING SYSTEMS; M. J. Finnegan, New York, N. Y. App. filed Jan. 18, 1926. For use in buildings having a large number of elevators and considerable traffic.

1,608,118. SOCKET SWITCH; W. G. Peet, Newark, N. J. App. filed Jan. 23, 1925. Pull chain.

1,608,122. LOCK SWITCH; E. P. Hummel, Sterling, Col. App. filed Oct. 3, 1924. Combination lock and switch.

1,608,131. ELECTRICAL HEATING DEVICE; F. Marion, Barre, Vt. App. filed March 2, 1926. For applying and conserving heat generated electrically; means for efficiently heating stoves, furnaces and for heating and vaporizing liquids. Specifically it is adapted to the vaporization of water in such manner as to supply steam to a heating system, and it may be used as an auxiliary to an ordinary coal-burning boiler and circulation system or as the sole vaporizing unit for such a system.

1,608,166. BATTERY-PLATE CONSTRUCTION; T. S. Cole, New Haven, Conn. App. filed Oct. 8, 1924.

1,608,184. BONDING AND SPACING CLAMP; A. C. Rumble, Los Angeles, Cal. App. filed May 22, 1924. For use in connection with the underground cables of street-lighting systems.

1,608,196. DRY CELL AND METHOD OF MANUFACTURE; L. G. Berigan, Madison, Wis. App. filed Feb. 5, 1926.

1,608,201. ALARM SYSTEM; J. M. Coburn and J. M. McCrary, Long Beach, Cal. App. filed March 2, 1922. The switch member of which is adapted to operate in conjunction with a door lock.

1,608,250. PLATING METHOD; R. J. Shoemaker, Chicago, Ill. App filed July 13, 1923. Method of coating or plating metal articles, particularly of iron or steel.

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from the entire Kuhlman Organization

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PAGE 7

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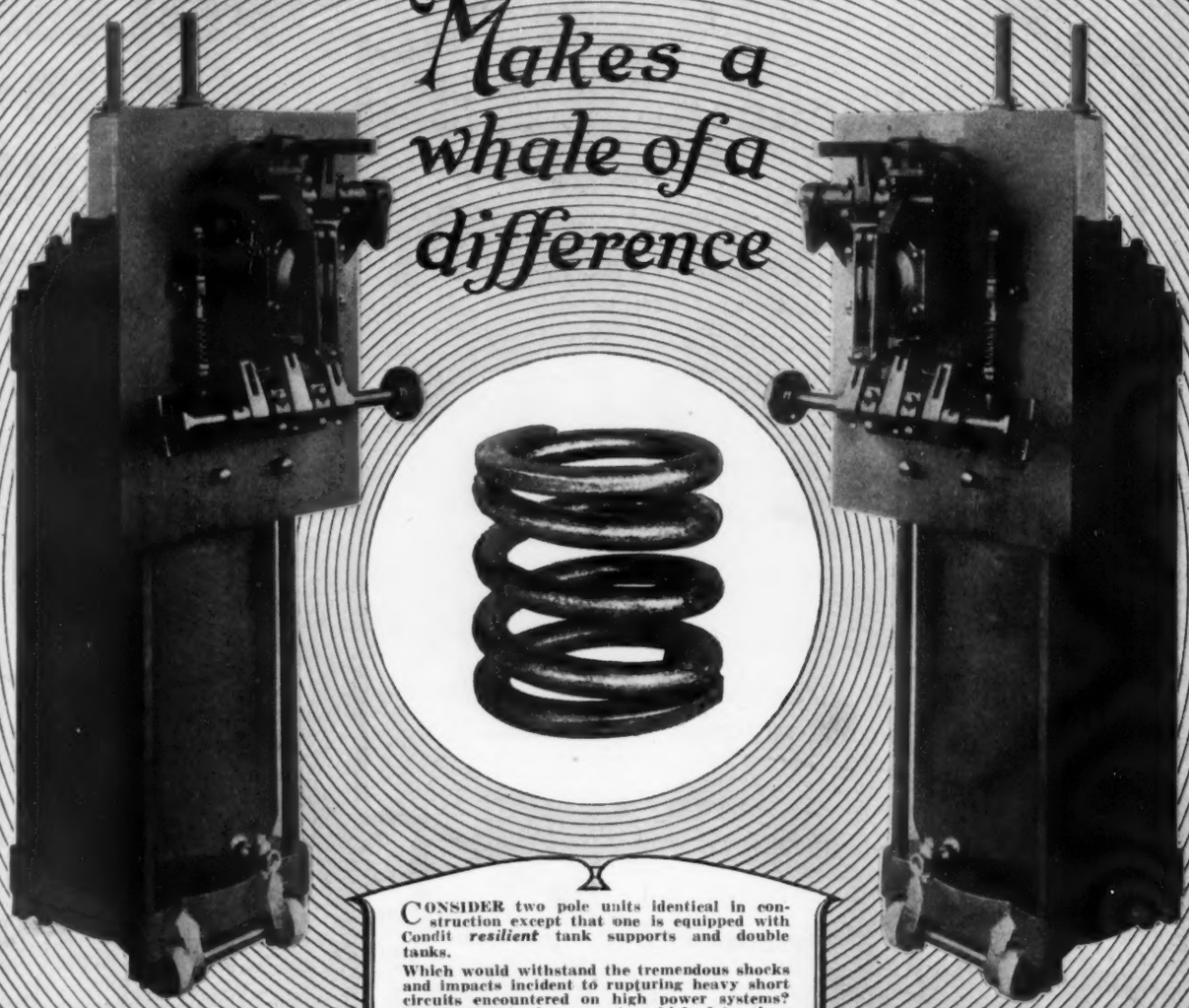

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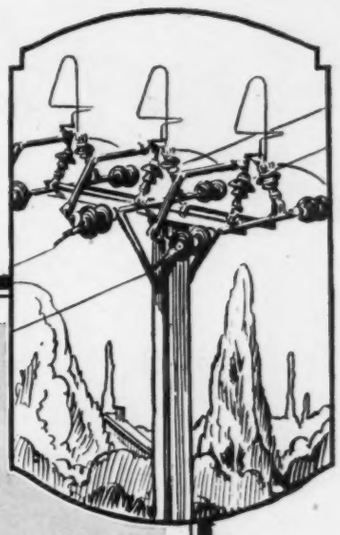

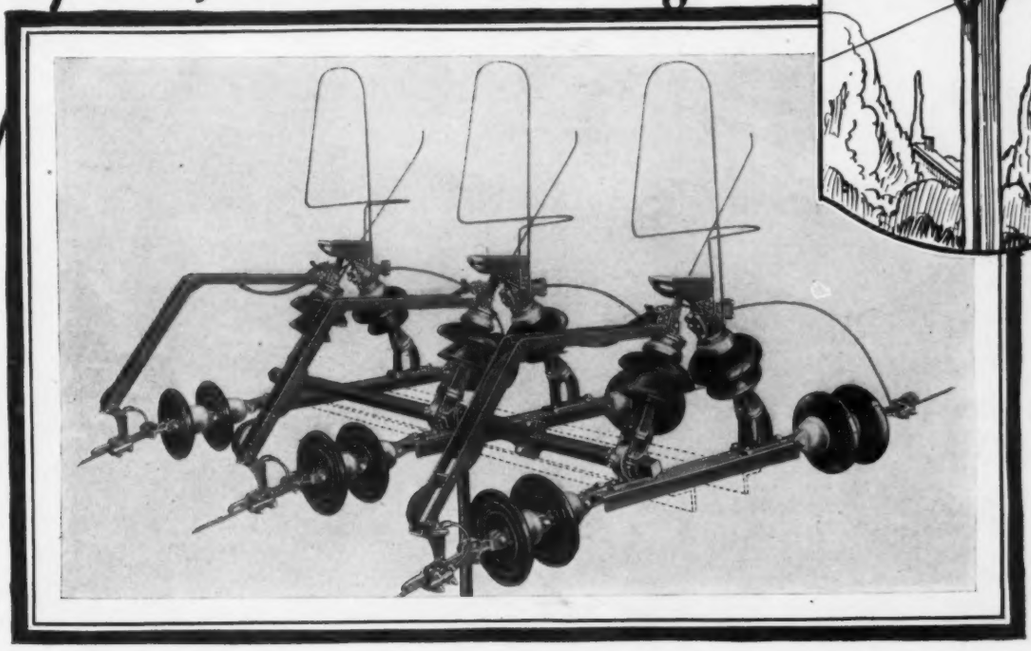

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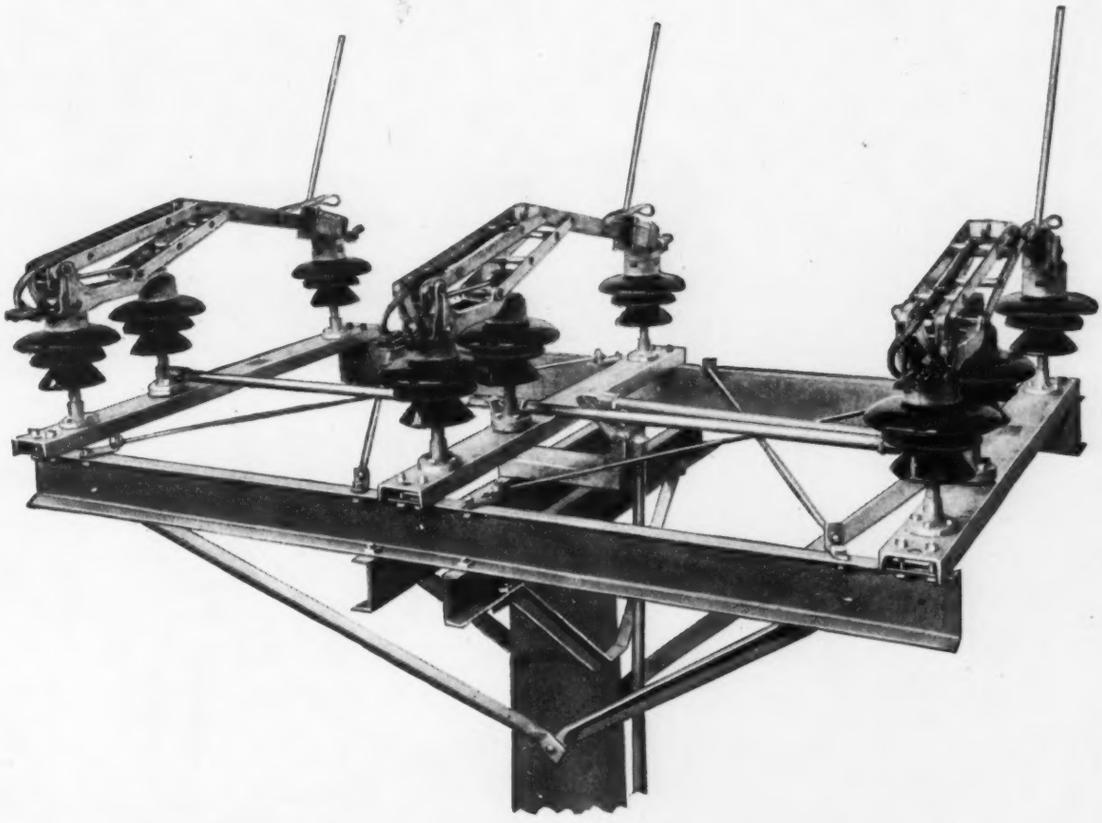

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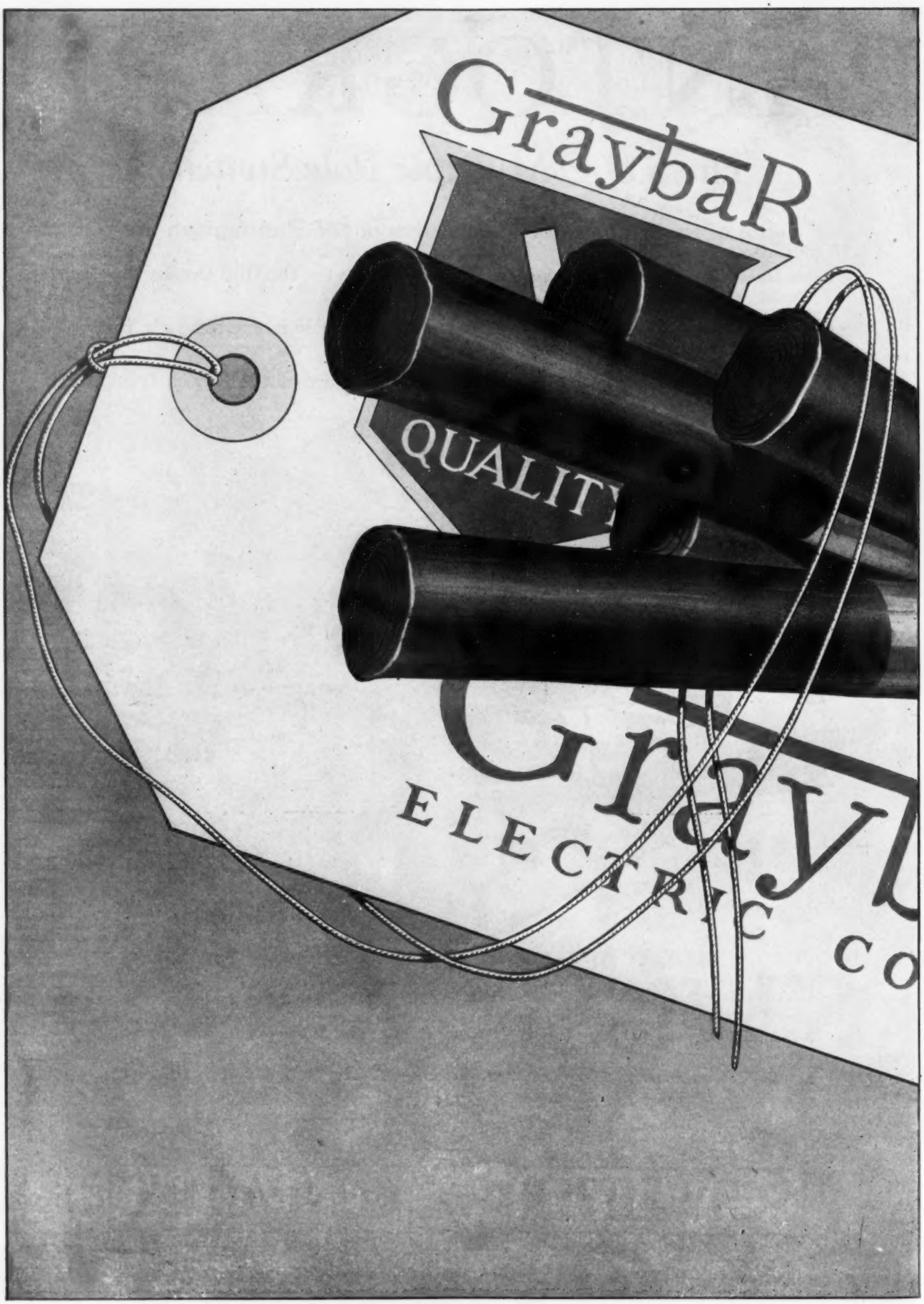
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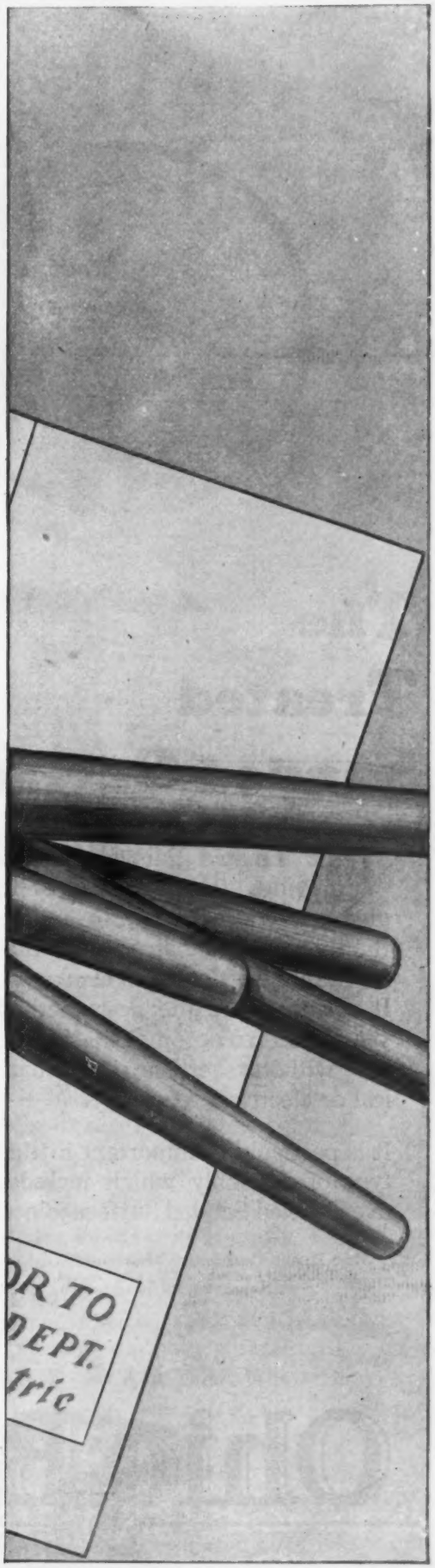

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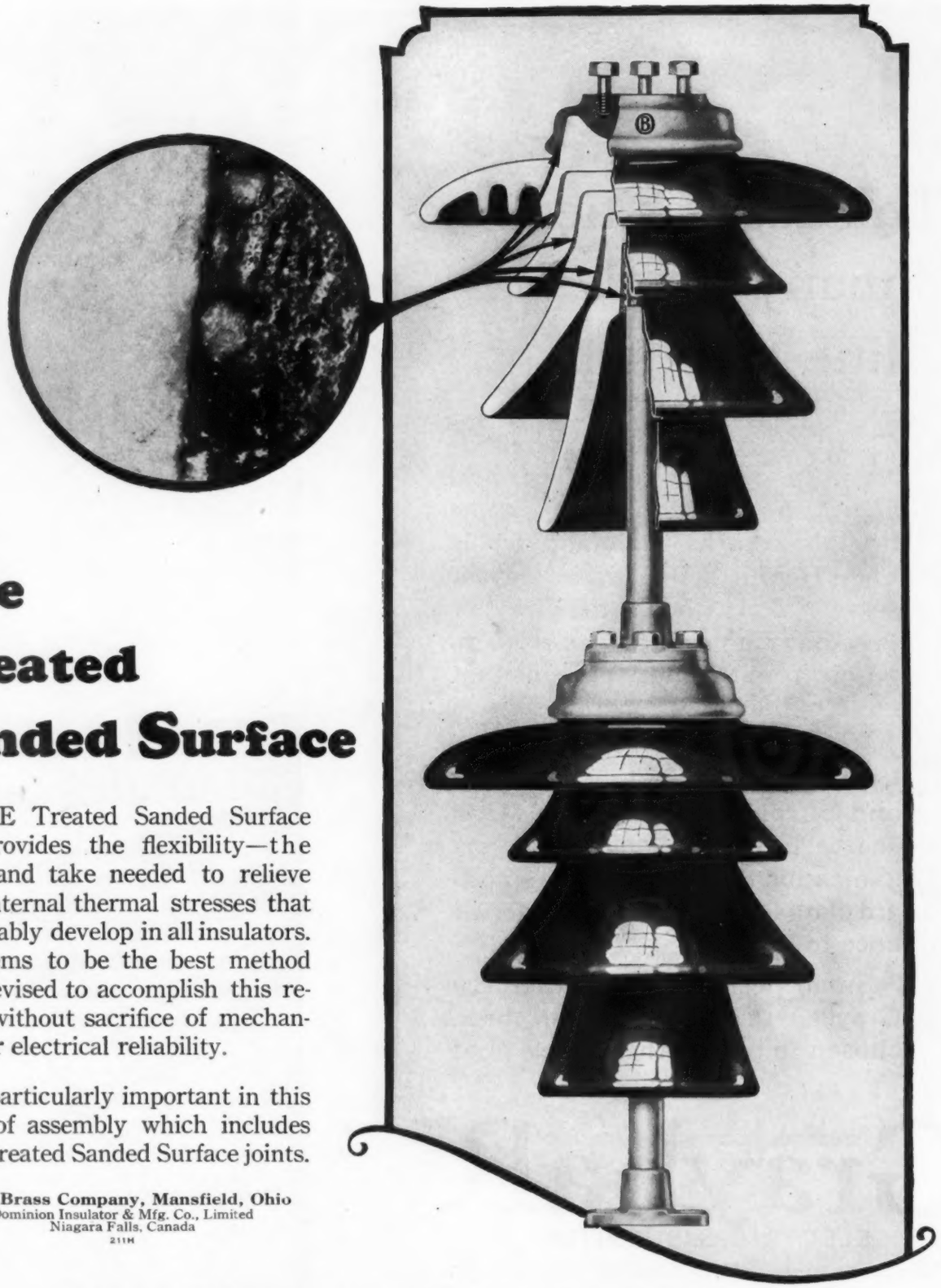

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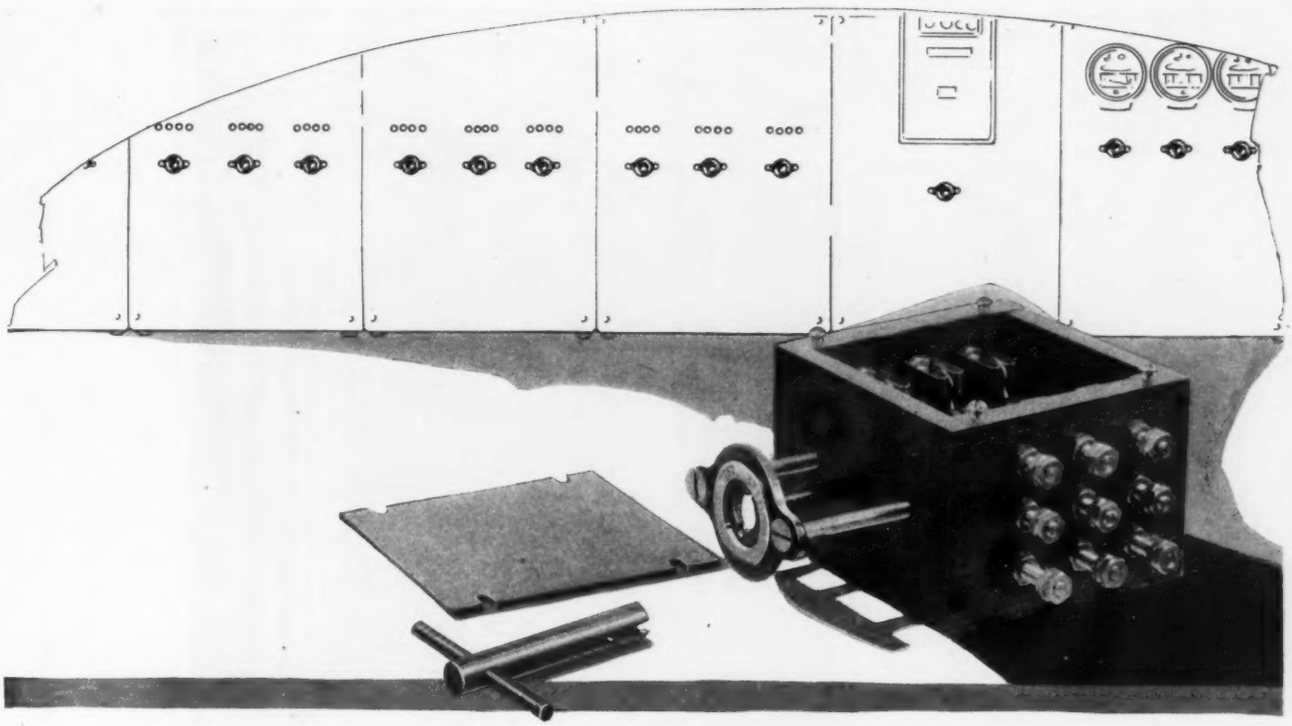
MINING MATERIALS
VALVES



Now you can test
METERS AND RELAYS
from the front of the board

When your men test from the back of the board they're always in danger of voltage shock from tripping a reactor.

—or coming in contact with oil switches and busses

—or opening the secondary of a current transformer

The Elpeco Meter and Relay test [R.T.] Switch at once removed these hazards and gives you the following advantages:

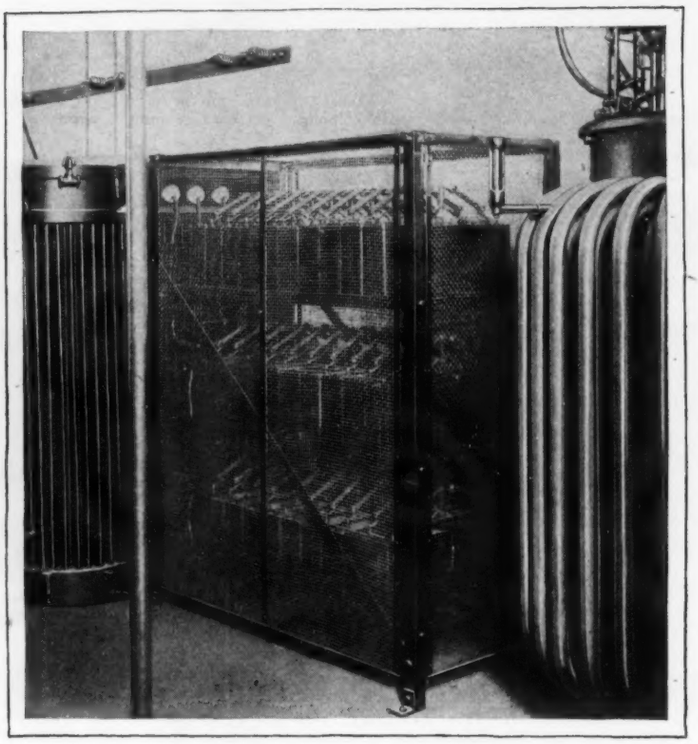
Reduction in time required to test
Fewer men to test more instruments
The facility to quickly cut out of service any relay
The advantage of testing with the line in service
No possibility of wrong connections after test

Your meter or relay engineer will find in Elpeco Bulletin No. 603 all the data on this simple device which so greatly increases switchboard serviceability.

ELPEC

ELECTRIC POWER EQUIPMENT CORPORATION

412-420 NORTH EIGHTEENTH ST. PHILADELPHIA, PA.



This is one of the G-E Capacitors installed by the Reo Motor Car Company, Lansing, Mich., to take advantage of lower rates offered for power used at high power factor. The results in detail were given by Mr. E. T. Anderson, in the ELECTRICAL WORLD for Sept. 25, 1926.

The power of high power factor
from the utility's point of view

Here is proof that a utility can obtain additional generating and distribution capacity through improvement in power factor at a much less cost than by installing additional generators and lines. Briefly, this is the story:

The power customer installed the corrective equipment, taking advantage of a new rate schedule which enabled it to save the cost of the equipment in 14 months.

The utility lost a possible revenue of $6,000 a year, which is equivalent to payment of the annual charges, at 15%, on an investment of $40,000 for additional equipment to produce the same result.

But—

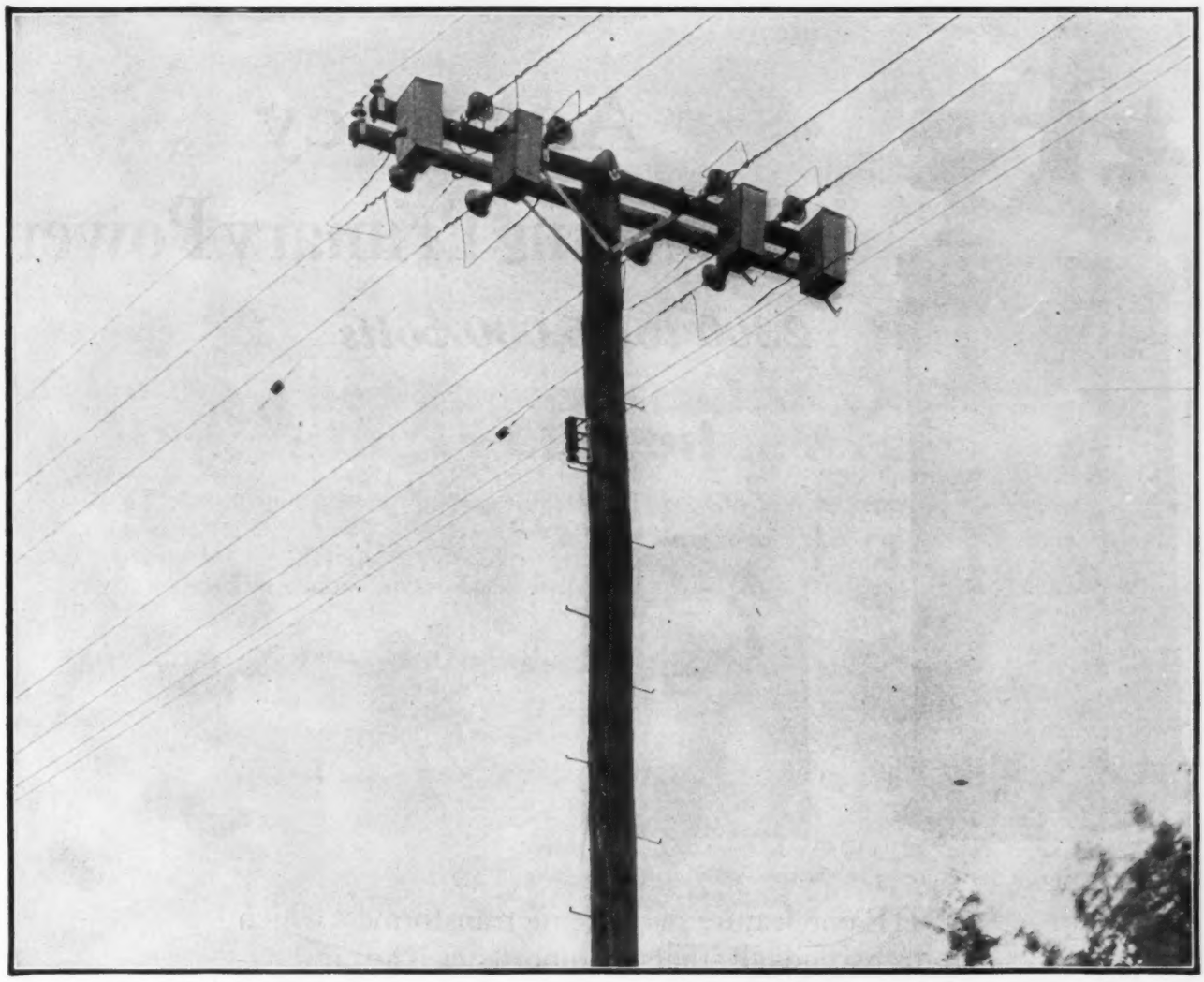
The additional capacity gained was about 1400 kv-a.,—and this amount of generator, feeder, and transformer capacity could not be installed, of course, for $40,000, or approximately $30 per kv-a. Besides this saving, the higher power factor has decreased losses in the system and improved voltage regulation.

Each power factor correction problem has its special engineering and economic considerations. Just as G-E engineers aided in this instance with recommendations which resulted in an installation profitable to both the utility and the industrial plant, they will give you unbiased assistance with any power factor problem.

850-6

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

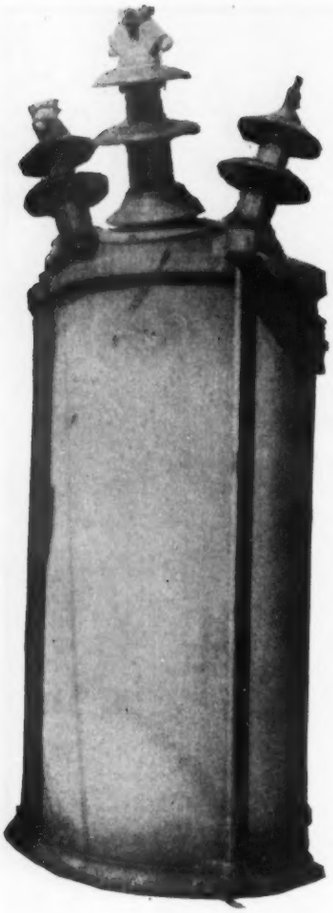


A Three Phase, Four Wire Interconnecting Point

Switches used for interconnecting purposes must be ready for service at all times. They are only in operation after some source of supply has failed. A switch, to function satisfactorily for interconnection purposes, must be unfailing in its operation. It must have large contact surfaces, because often times it is called upon to carry excessive overloads. It must be easy to operate and afford the operator a maximum degree of safety. Matthews Disconnecting Switches do all of this and more. Power companies daily are appreciating these wonderful switches more and more with the result that complete standardization of Matthews equipment is being obtained. For further information pertaining to Matthews Fuswitches and Disconnecting Switches write for Bulletin No. 501 —or if you prefer, our representative will call.

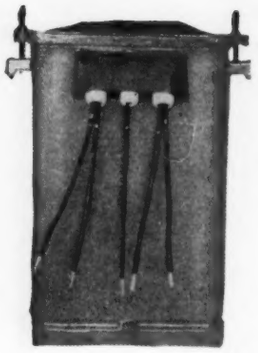
W. N. MATTHEWS CORPORATION
3702 Forest Park Blvd., St. Louis, Mo., U.S.A.

79



Accuracy in Metering Primary Power

2300 to 66,000 volts



THE one feature in metering transformers which transcends all others in importance is accuracy—accuracy not only at the time of initial installation, but accuracy through long years of use.

The Packard Electric Co. offers in their Type PCW —(combination potential and current, weatherproof) an exceptional degree of accuracy in all sizes from 2,300 V. to 66,000 V.

Characteristic curves, as well as other data will be found in our bulletin No. 208A.

In addition to accuracy we offer a very compact unit, taking care of both current and potential—mounted in a steel tank—oil immersed—weatherproof—may be mounted anywhere.

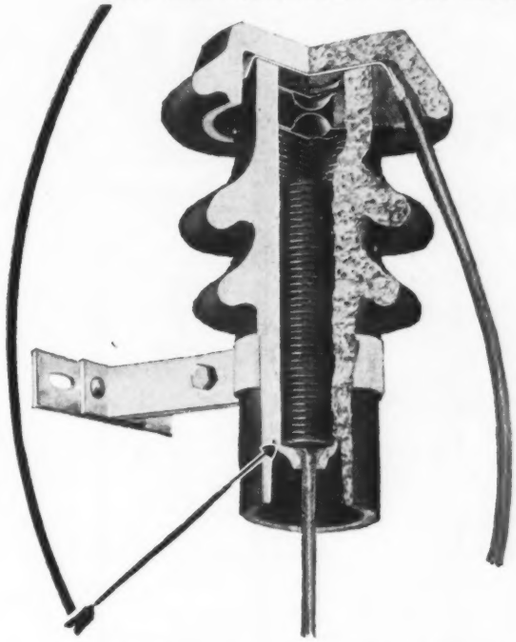
The Packard Electric Company

Warren, Ohio

Packard is never seen, except on goods of honest value

When Superintendents Meet "Speaking of Lightning Arresters"

IT was during one of those confidential chats that the talk turned to lightning arresters. "Yes", the central station superintendent was saying, "I am strong for the LV Autovalve Arrester because of its maintained leadership in new and constructive ideas about distribution circuit protection.



"It was the first to give us the valve principle of operation for distribution circuit protection.

"The separate mounting bracket was a desirable innovation.

"We can now install arresters with one principle of operation on all our distribution circuits, up to 50 kw.

"Prior to the LV, the high cost of high-quality, higher-voltage arresters prohibited the adequate protection of all our distribution systems.

"The small size and light weight of the higher-voltage LV arresters minimize our installation costs.

"The 'drop out' feature of the latest LV is a definite tell-tale of the arrester condition that an inspector can see readily from the ground.

"Should a sustained over-voltage, or direct stroke, cause the failure of one of these arresters, the 'drop out' functions and our line does not become permanently grounded."

The decreased portion of porcelain which fractures when the 'drop out' functions because of a sustained over-voltage, or a direct stroke.

Talks of this character are common wherever central station superintendents meet.

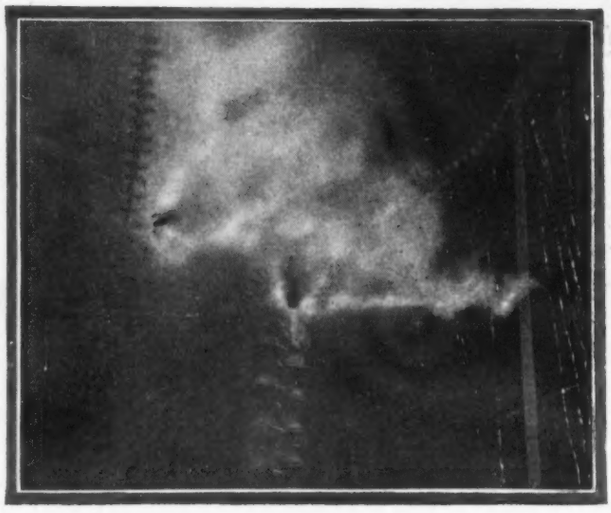
Leaflet 20013 and Circular 1737 describe this trail-blazer in the art of distribution circuit protection.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania

Sales Offices in All Principal Cities of the United States and Foreign Countries

Westinghouse

X90186



When

Super-Power *Cuts Loose*

—a crash, a burst of flame twenty-five feet high. Sixteen thousand electrical horsepower dissipated into heat and light. Then the line's protective devices operated . . . . . .

A popular magazine thus dramatically presents the necessity for positive protective devices—which, in super-power, means relays.

Westinghouse protective relays meet this necessity. Their operation is positive not only for a condition so severe as a short circuit or ground, but also for the many less serious disturbances occurring constantly in long, high-voltage lines.

Westinghouse Electric & Manufacturing Company
Newark Works, Newark, N. J.
Sales Offices in All Principal Cities of the United States and Foreign Countries

W WESTINGHOUSE ELECTRIC

Westinghouse
X91022
RELAYS

No. 631
Recommended Working Load. 6000 lbs Rated Combined M and E Strength. 18,000 lbs.
Reserve Strength Ratio 3:1

Strength ~~Power~~ in Reserve

THE hilltop is reached—easily, surely, safely—because of the reserve power built into the motor. The car continues to function efficiently, because of reserve strength designed and built into it. But road conditions are always a factor—just as transmission conditions are a factor in insulator behavior.

Fewer towers to the mile; higher voltages; heavier cables—should not insulators be built *up* to these higher requirements?

Westinghouse insulators are built with the necessary reserve strength over that required by normal loading. The strength starts with the design. Their service, under the maximum demands, is proof that the reserve strength is there—actually.

Westinghouse Electric & Manufacturing Company
Westinghouse High Voltage Insulator Works
Derry, Pa. Emeryville, Cal.
Sales Offices in All Principal Cities of the United States and Foreign Countries X90195

Porcelain
you can install *– and forget*

— because science — not tradition — governs the making of all Westinghouse porcelain and insulators.

— precision processes, at every stage, are the rule.

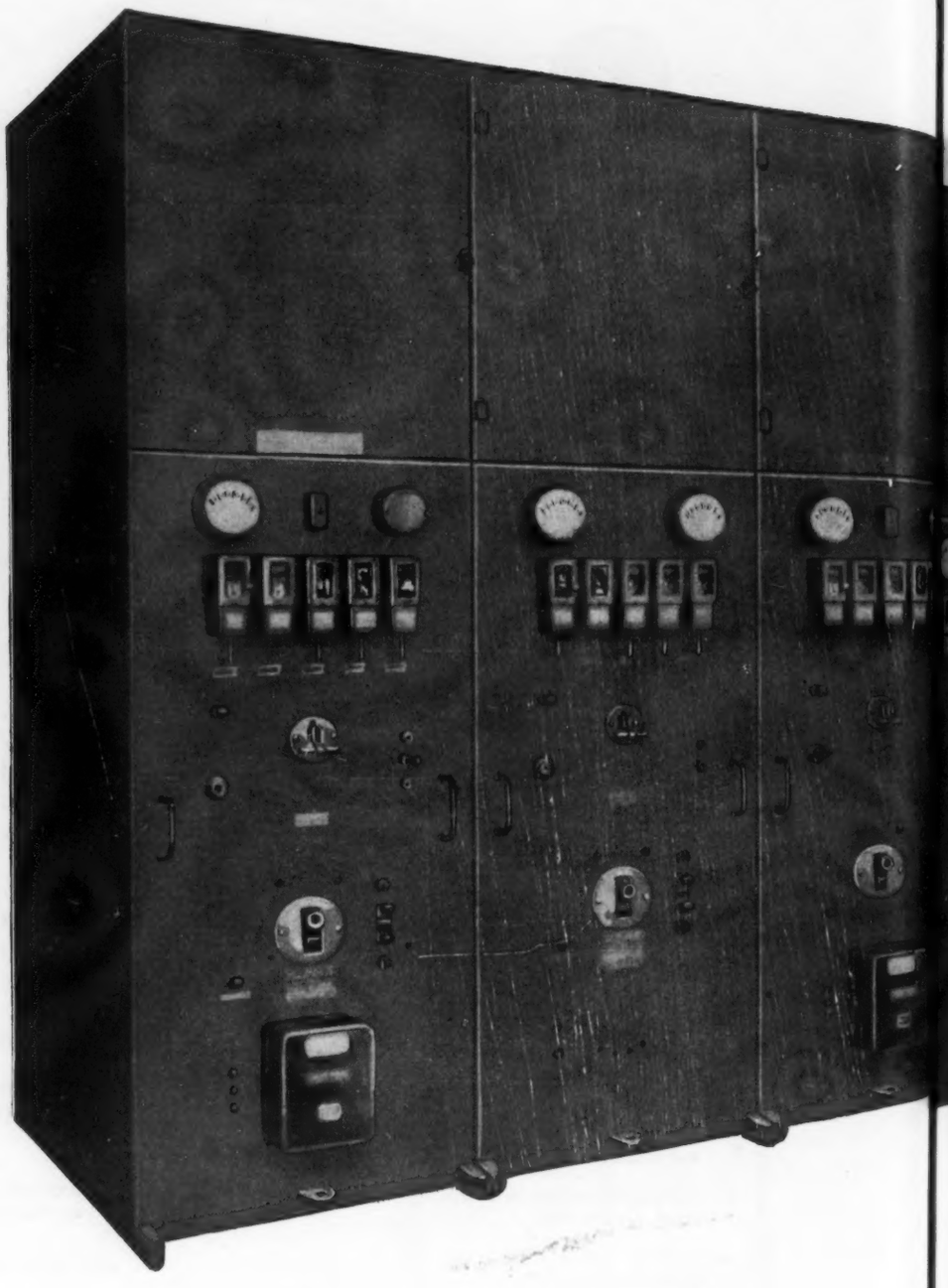
— never is anything taken for granted at any time.

— even slight variations in materials are compensated for.

First the design—then the materials—then the method—and then, a vigilance that permits no compromise.

Insulators with Reserve Strength

Westinghouse



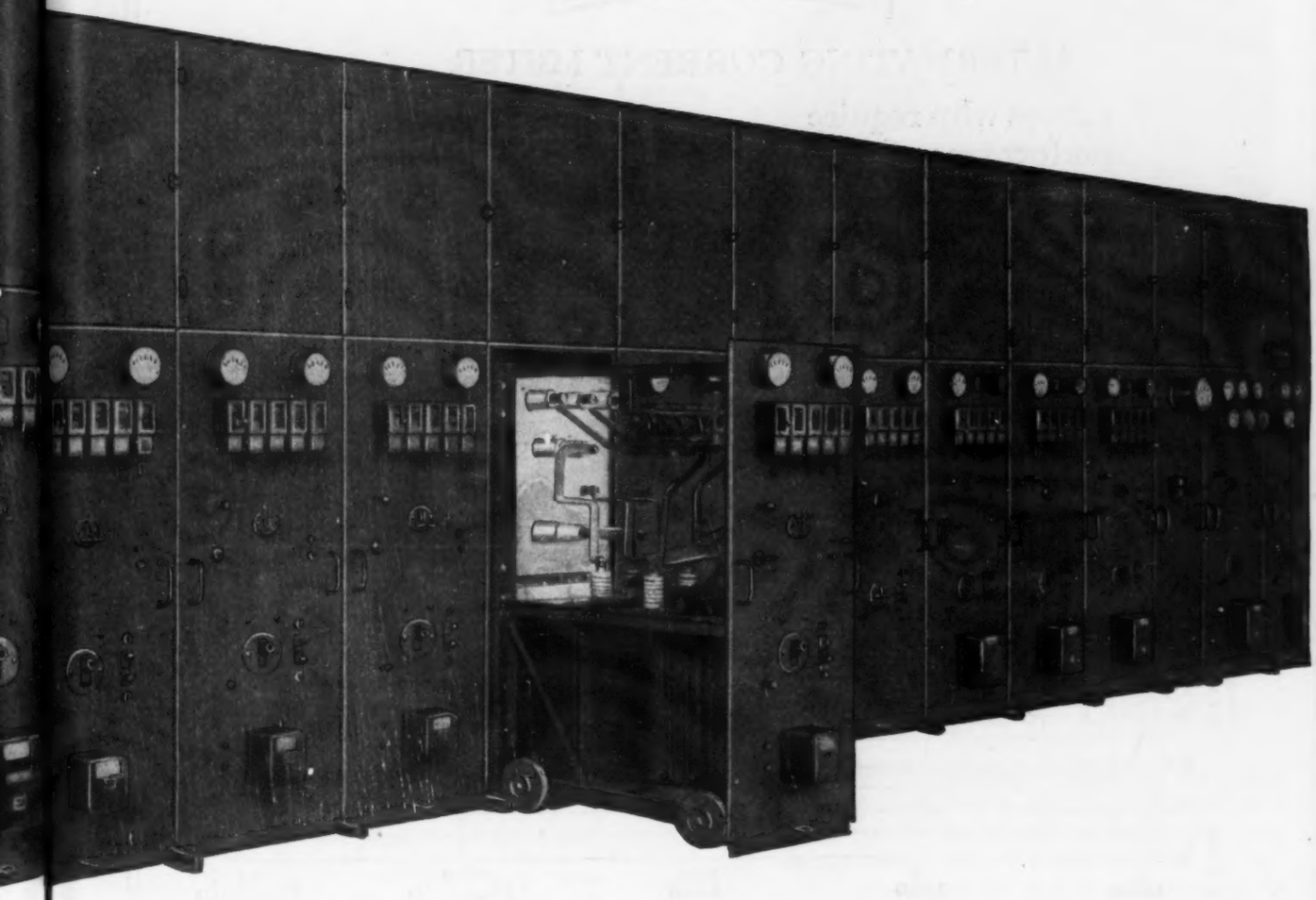
Factory-built
—*complete*

General Electric's engineering staff is constantly at work to improve Switching, Protective, and Control Equipment—the vital factors in the distribution of electric power. These men are available to study your distribution problems, to apply the equipment that is best suited to your particular requirements. Depend upon General Electric for all equipment of this class—both indoor and outdoor, manual and automatic.

Adopted by leaders

GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK



A dozen leading central stations that have in use nearly a thousand G-E Truck Panels. Repeat orders average three per company:

Brooklyn Edison Company
Duquesne Light Company
East Penn. Electric Company
Illinois Power & Light Company
Indianapolis Light, Heat & Power Co.
Louisville Gas & Electric Company
Northern States Power Company
Nebraska Power Company
New York Edison Company
Pacific Gas & Electric Company
Union Electric Light & Power Company
United Electric Light & Power Company

These are only a few of the central station users of G-E "Trucks". They all find this type of Switchboard particularly suitable for station auxiliaries. Some have installed Truck Panels as separate feeder panels for large industrial loads, even housing them in simple outlying substations—and with complete success.

Consult the switchboard specialist in your G-E District Office as to the four basic advantages of "Trucks".

GENERAL ELECTRIC

SALES OFFICES IN ALL PRINCIPAL CITIES

FERRANTI

ALTERNATING CURRENT METER

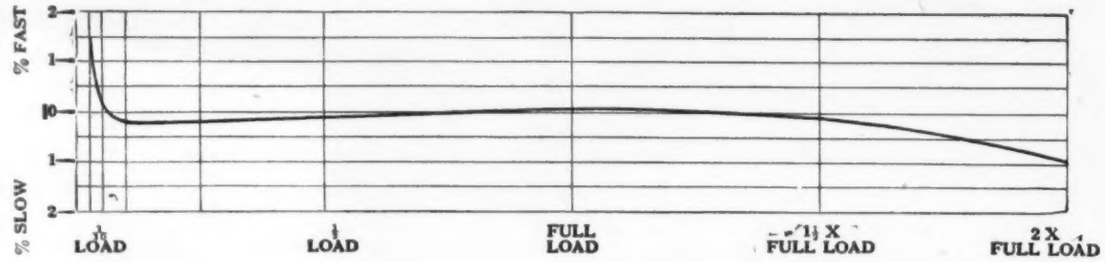
for those who require performance first

No Better Meter is Available at Any Price.

1. The material used is the finest obtainable.
2. The workmanship is of the highest standard.
3. The design incorporates intensive knowledge acquired during 40 years of meter building in co-operation with users throughout the world.

Type EC5

LOAD CURVE



TECHNICAL DATA

Torque. 4.7 gram-centimeters.

Weight of Rotor. 27 grams.

Speed at full load. 32 revs. per minute.

Starting Watts. 0.5% of rated full load.

Shunt Loss. 1.5 watts.

Series Loss. 0.6 watts at rated current.

Changes due to variation of **Voltage, Frequency** and **Temperature** are negligible.

Weight. 9 lbs. 4.1 kg.

Overall Dimensions.

9 inches × 7¼ inches × 6 inches.

228 mm. × 184 mm. × 152 mm.

Ferranti, Inc.
130 West 42nd Street, New York, U. S. A.

Ferranti, Ltd.,
Hollinwood, England

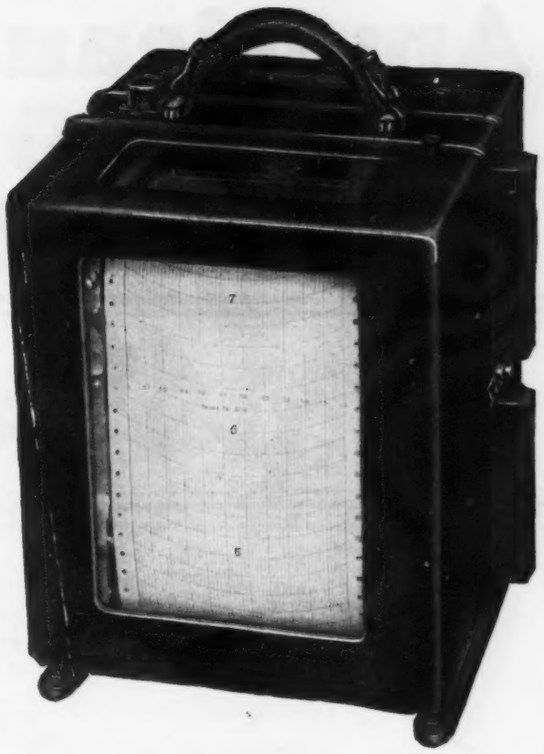
Ferranti Electric, Ltd.,
26 Noble Street, Toronto, Canada

Announcing

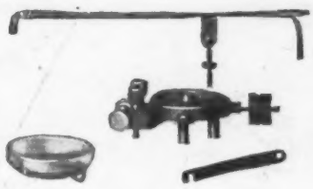
Audio Frequency
Ferranti Transformers

Of interest to all electrical engineers is the entrance of Ferranti into the radio field with Audio Frequency transformers having very flat curves over the entire audio frequency range from 25 to 8,000 cycles.

For the best obtainable transformer results—Ferranti Audio Frequency Transformer A. F. 3—ratio 3½ to 1 —$12. For a transformer far superior to the average, use Ferranti A. F. 4—ratio 3½ to 1—$8.50.



A Simple Inking System



The inking system is of the siphon type. The complete element is mounted—on a platform on the upper end of the instrument shaft—in such a way that it is easily removable for refilling or cleaning. This is an important feature of instruments of this character, where the service is likely to be intermittent. The best ink obtainable becomes gummy or sluggish if allowed to stand for any length of time, necessitating a thorough cleaning of the whole system.

Two other features of this inking system are worthy of mention. An automatic pen-lifting device is provided, which, when the chart carriage is lowered, automatically lifts the pen and holds it up out of harm's way. The other is a locking screw on the main element shaft, which securely locks the element in place to protect the pen from possible damage when the instrument is being carried.

Away ahead in every important detail

The inking system, described here, is only one of the many features to which the superiority of these new G-E Recording Instruments can be attributed. True, these features are matters of detail, but only by perfecting the details can any superior instrument be produced. Other principal features are:

A superior chart-drive, the mechanism being a high-grade clock in the CP-4 Instrument and a Warren synchronous motor in the CP-5.

Improved potential circuits, which are broken as the door is opened, and with a multiple-voltage switch that is extremely positive in its action.

A damping system which, by reason of its use of mercury, is unaffected by temperature and gives just the characteristics desired.

The elements are shielded from stray fields—Reroll is of simple construction—Triple voltage capacity—Multiple chart speeds and facilities for quickly changing speed—Low losses in both potential and current circuits.

Refer to Bulletin GEA-304, or consult your G-E meter specialist, for a more complete description.

Ranges

Ammeters—capacities 5, 10, 15 or 20 amp.
Voltmeters—either double or triple rated.
Wattmeters—both single-phase and polyphase—with current ratings from 5 to 20 amp. The potential ratings may be either triple or double.
Power-factor meters—with 5-amp. current windings, the potential windings being either double or triple rated.
Frequency meters have single-voltage ratings.

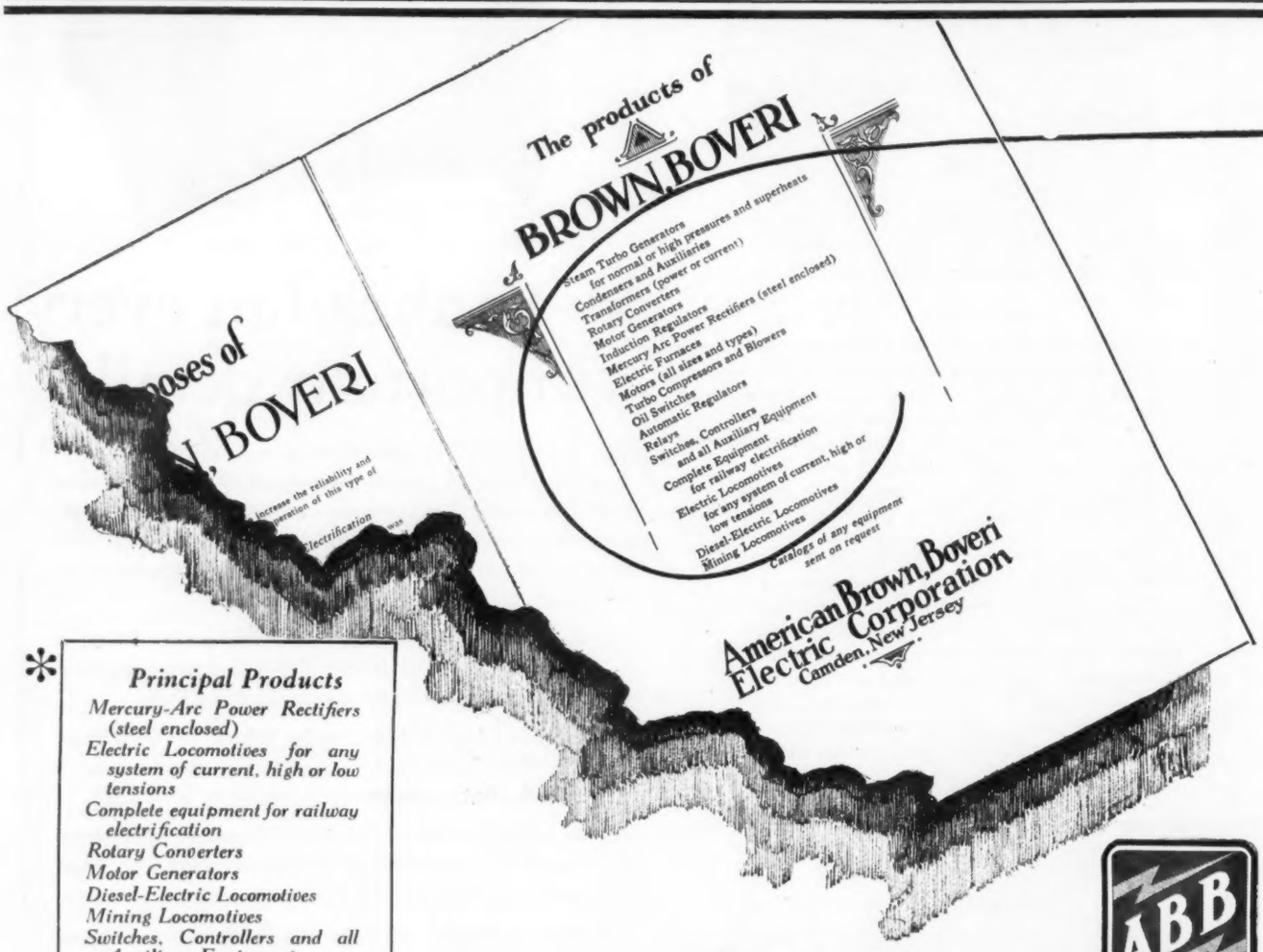
610-5

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

American BROWN BOVERI

A year ago .....


The products of
BROWN, BOVERI
Steam Turbo Generators for normal or high pressures and superheats
Condensers and Auxiliaries
Transformers (power or current)
Rotary Converters
Motor Generators
Induction Regulators
Mercury Arc Power Rectifiers (steel enclosed)
Electric Furnaces
Motors (all sizes and types)
Turbo Compressors and Blowers
Oil Switches
Automatic Regulators
Relays
Switches, Controllers and all Auxiliary Equipment
Complete Equipment for railway electrification
Electric Locomotives for any system of current, high or low tensions
Diesel-Electric Locomotives
Mining Locomotives
Catalogs of any equipment sent on request
American Brown, Boveri Electric Corporation
Camden, New Jersey

* **Principal Products**

Mercury-Arc Power Rectifiers (steel enclosed)
Electric Locomotives for any system of current, high or low tensions
Complete equipment for railway electrification
Rotary Converters
Motor Generators
Diesel-Electric Locomotives
Mining Locomotives
Switches, Controllers and all Auxiliary Equipment
Steam Turbo Generators for normal or high pressures and superheats
Automatic Regulators
Oil Switches
Condensers and Auxiliaries
Relays
Turbo Compressors and Blowers
Electric Furnaces
Induction Regulators
Ships
Diesel Driven
Turbine Driven
Electrical Driven
Structural Steel Fabrication

ABB

Reprint from the Electrical World, Nov. 7, 1925

AMERICAN

The Ninth of a Series

.... And to-day*

Extensions and improvements undertaken by American Brown Boveri during the past year as reviewed by the technical press substantiate our earlier determination to steadily strengthen the manufacturing facilities behind the products listed on the opposite page.

The American Brown Boveri Electric Corporation, 165 Broadway, New York, is planning extensions in its Camden (N. J.) plant, utilizing properties secured at the time of the original acquisition but not used heretofore in connection with current operations. The land primarily comprises what is known as the South Yard, located on the Gloucester side of Newton Creek. Alterations and improvements will be made in existing buildings and the necessary equipment installed. It is understood that the expansion will be used largely for the production of turbo-generating units.

From Electrical World, Sept. 11, 1926

... repair and ... N. J., to cost close to $100,000, with equipment.

The American Brown-Boveri Electric Co., Broadway and Fairview Street, Camden, N. J., operating at the former plant of the New York Shipbuilding Co., is said to have plans under way for a shop addition, 60 x 175 ft., to cost more than $50,000 with equipment. It will advance operations at the yard, and has developed a system of standardized ship construction for larger output. Contracts have just been received for the building of 33 steel patrol boats for the United States Coast Guard Service, to cost $63,000 each, and for 6 Diesel engine-electric ferry boats for the Erie Railroad, New York.

From Iron Age, June 10, 1926

From Railway Age, July 3, 1926

THE announcement that an order for 7 electric locomotives has been awarded to the American Brown-Boveri Electric Corporation ..... is bound to give rise to considerable speculation. It is the announced policy of the American Brown-Boveri Electric Corporation to promote railroad electrification in particular. ..... The need for electrification continues to increase slowly but steadily and it would appear that there is increasing reason for railroad associations to renew their study of this phase of the situation.

The Railway & Industrial Engineering Company, Greensburg, Pa., manufacturer of transmission, switching and protective equipment, is consolidating its plant with that of the Electrical Development & Machine Company, Philadelphia, manufacturer of the "Franklin" line of power equipment. The Railway & Industrial Engineering Company, which recently purchased property adjoining its plant, as announced in the May 22 issue of the ELECTRICAL WORLD, is enlarging its plant facilities, and a new building under construction will be occupied by the Electrical Development & Machine Company, which will move its plant from Philadelphia.

From Electrical World, June 26, 1926

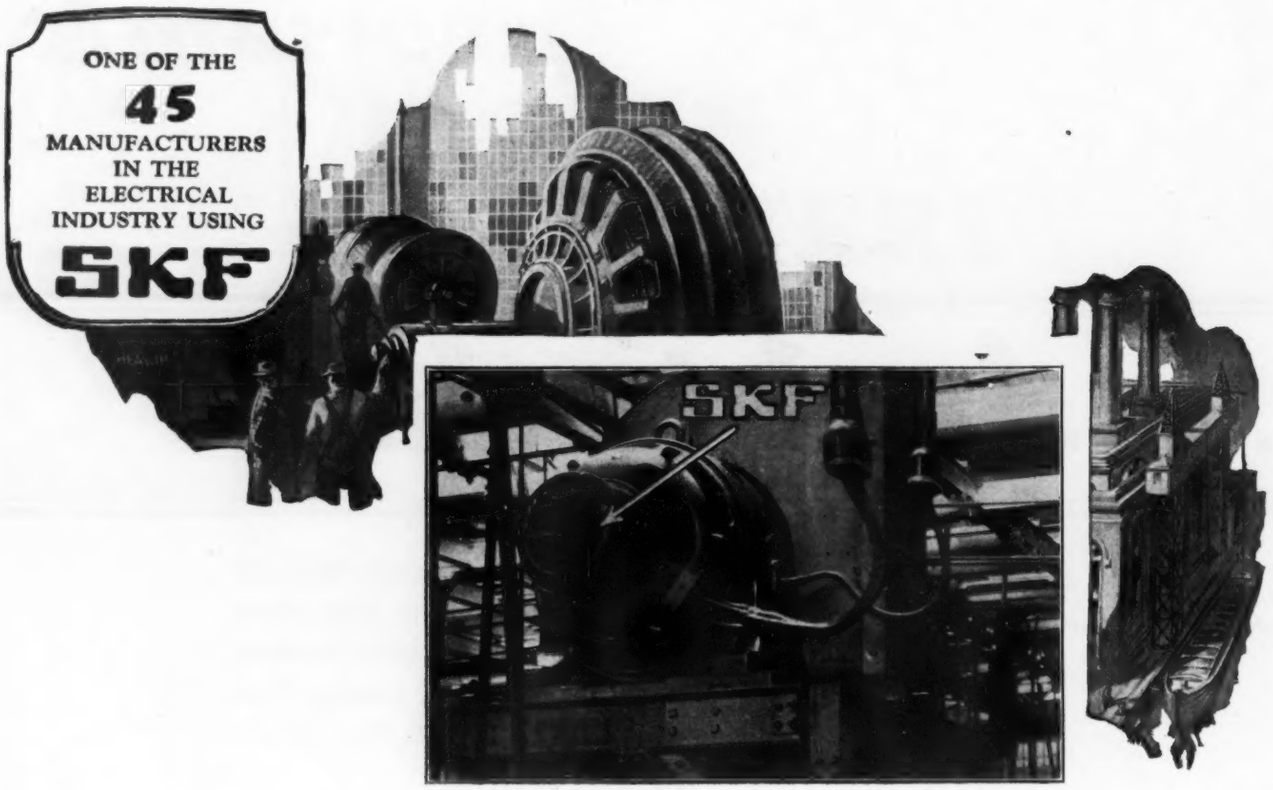
AMERICAN BROWN BOVERI ELECTRIC CORPORATION

165 Broadway, N. Y. Camden, N. J.

230 South Clark Street, Chicago

842 Summer Street, Boston 922 Witherspoon Bldg., Philadelphia

BROWN BOVERI



SKF-Equipped Motors Save $1,493.10 Per Year

Certified Survey No. 1703 in your Industry or one closely related to it Sent on request.

"IN addition to the operating advantages of the ball bearings, there is a saving in oil and oiling labor amounting to $1,493.10 per year," states the superintendent of a plant in which motors equipped with SKF-marked Ball Bearings range in size from 2 to 200 H.P. and a combined rating of over 2,700 H.P.

"The motors are gone over three times a year. The performance of these motors is really a surprise after being accustomed to babbitt bearing motors which always gave trouble. The work they do and the savings they effect make the ball bearing motors a very profitable investment."

Ask for Certified Survey on this Installation.

SKF INDUSTRIES, INCORPORATED
165 Broadway, New York City

1703

More than 100 Factory Offices Throughout the World
SKF
Puts the Right Bearing in the Right Place
Ball Bearings
Roller Bearings

Base Campaigns on Information

SALES campaigns without sales information are dangerous things. This is especially true of what might be called pioneer devices or campaigns which sell equipment with the object of increasing service indirectly. Hurriedly conceived ideas for sales only seldom can be carried out successfully. It is necessary first to investigate the subject, next to collate the data needed, and then to train salesmen and prospective customers in the realm of utilization of the sales product. Those who have done this kind of work have most of the information and experience necessary to the institution of successful campaigns in other localities. Their data and experiences should be made available to all. For the key to any successful sales program is better service and a satisfied buyer, and it would seem evident that sales information from the buyers' standpoint is essential.

Campaigns to sell electric heat, electric baking, industrial lighting, show-window lighting, ranges, refrigerators and water heaters are typical of those which can be improved enormously by having sales data and a skilled sales staff. It is the part of wisdom to investigate thoroughly and plan thoroughly before "jumping off" to sell under high pressure.

Well said!

(An editorial from Electrical World Dec. 18th issue)

and (may we add) **known* technical data should always precede sales promotion....**

that's our business

Electrical Testing Laboratories
80th Street and East End Avenue,
New York City

*KNOW
—by test.

"The fact is, that civilization requires slaves. The Greeks were quite right there. Unless there are slaves to do the ugly, horrible, uninteresting work, culture and contemplation become almost impossible. Human slavery is wrong, insecure, and demoralizing. On mechanical slavery, on the slavery of the machine, the future of the world depends."
—Oscar Wilde

SLAVES

In a quarter century the General Electric Company has produced electric motors having a total of more than 350,000,000 man-power. Electric light, heat, and transportation have also contributed their part to the freeing of men. These are America's slaves. Through their service American workers do more, earn more, and produce quality goods at lower cost than anywhere else in the world.

You will find this monogram on all kinds of electrical machinery. To insure quality, ask for it on the equipment you buy for your factory, office, or home.

95-298

GENERAL ELECTRIC

This is one of the industrial units in the General Electric Company's continuous educational campaign.

The above advertisement appears in the Saturday Evening Post, Dec. 25, and in December issues of several other periodicals of national circulation.

Have you received "Electricity and the American Public" (Book No. 6), containing preprints of these advertisements and co-operative publicity suggestions?

You may not want These Things

When you build your new plant, speed in completion may not be important to you. Low cost may not be a prime consideration. Guaranteed quality of materials and workmanship may not worry you — but if you do want these things, Austin can give them to you. Here's how:

New million dollar plant of the G. A. Gray Co., Cincinnati, designed and built and equipped by Austin

In advance, Austin guarantees the total cost for the complete project; also the completion date, with bonus and penalty clause if preferred; as well as quality of materials and workmanship.

Under the Austin Method of Undivided Responsibility, one contract covers the complete project—engineering, building, and equipment.

A permanent nation-wide organization trained in the Austin Method, vast experience and data, and extraordinary facilities make possible the amazing speed in design and construction for which Austin is famous together with the lowest cost consistent with high standards of quality.

That is what has won leadership for Austin in the industrial building field, and the deserved confidence that results in many repeat contracts. If these things appeal to you, wire, phone or send the coupon for valuable building data.

Approximate costs on a project of any size will be furnished gladly, without obligation. Don't wait until spring if you need new plant facilities—Austin can furnish them now.

THE AUSTIN COMPANY - *Engineers and Builders* - Cleveland

New York, Chicago, Cleveland, Detroit Philadelphia, Portland, Seattle, Miami, Pittsburgh, St. Louis
The Austin Company of California: Los Angeles and San Francisco The Austin Company of Texas: Dallas

AUSTIN

Complete Building Service

THE AUSTIN COMPANY, Cleveland
We are interested in the erection of a _____
_____ Building
_____ x _____, number of stories _____
You may send me a personal copy of "The Austin Book of Buildings," free to Industrial Executives.
Firm _____
Individual _____
Address _____
EW 12-26

All of these debentures have been sold

New Issue December 13, 1926

$20,000,000

Berlin City Electric Company

Incorporated

(BERLINER STAEDTISCHE ELEKTRIZITAETSWERKE AKT.-GES.)

Twenty-Five Year 6½% Sinking Fund Debentures

To be dated December 1, 1926 To mature December 1, 1951

A substantial portion of this issue has been withdrawn for simultaneous offering in Europe by Mendelssohn & Co. Amsterdam, Nederlandsche Handel Maatschappij, Pierson & Co., R. Mees & Zoonen and others.

To be authorized and issued $20,000,000. Interest payable June 1 and December 1. Principal and interest payable in New York City at the principal office of Dillon, Read & Co., in United States gold coin of the present standard of weight and fineness, without deduction for any German taxes, past, present or future. Coupon debentures in denomination of $1,000, registerable as to principal only. In addition to redemption at par for the sinking fund only, the debentures are redeemable as a whole, or in part by lot, on any interest date, on thirty days' notice, at 102½ and interest on or before December 1, 1931, and thereafter at 100 and interest. Central Union Trust Company of New York, American Trustee. Reichs-Kredit-Gesellschaft A. G., Berlin, German Trustee.

The company agrees to provide a sinking fund, payable in equal semi-annual instalments of approximately $430,000, first payment June 1, 1929, sufficient to retire the entire issue by maturity by purchase at not over 100 and interest, or, if debentures are not so obtainable, by call by lot at that price.

The following information is summarized from a letter from Dr. Lange, Treasurer of the city of Berlin, and Dr. Kauffmann and Mr. Rehmer, Managing Directors of Berlin City Electric Company, Incorporated:

The city of Berlin owns all of the company's capital stock and has entered into an agreement with the company, extending beyond the maturity of the debentures, empowering the company to fix rates for the sale of electricity adequate to cover all operating expenses, interest and amortization of loans, depreciation and other proper reserves, and providing that, upon termination thereof, the city shall assume all obligations of the company, including interest and amortization of loans.

These Debentures are listed on the Boston Stock Exchange and the company has agreed to make application to list them on the New York Stock Exchange.

Statements herein have been received partly by cable, and are in no event to be construed as representations by us.

We offer these debentures for delivery if, when and as issued and accepted by us, and subject to approval of legal matters by our counsel. It is expected that delivery will be made on or about December 22, 1926, in the form of temporary debentures of the Company or interim receipts of Dillon, Read & Co.

Price 98 and interest. To yield over 6.65%

The above is subject to a circular, containing further information, which may be obtained upon request.

Dillon, Read & Co.

Hallgarten & Co.

Halsey, Stuart & Co.
Incorporated

International Acceptance Bank, Inc.

Mendelssohn & Co.
Amsterdam

To help sell Battery Chargers and Sets! TIREX SJ *Cord*

Another popular use for Tirex SJ Cord is on battery chargers and for permanently connecting radio storage batteries.

The salesman who can point to Tirex SJ Cord as a selling feature of a battery charger—has all of the customer's attention as every radio fan knows how the ordinary flexible cords of chargers soon are eaten through by the acid from the battery.

Tirex SJ Cord is made exactly like Tirex Portable Cord, the only difference being that Tirex SJ Cord is listed only in sizes No. 16 and No. 18 and that it is lighter in weight and smaller in diameter than the Tirex Portable Cord.

Tirex SJ Cord is immune against acid solutions thus making it the choice of battery charger manufacturers.

For all electrical portable cord devices not requiring Tirex Portable Cord, with the exception of heating appliances which require a special cord, Tirex SJ is recommended.

Our new pamphlet and a sample piece of Tirex SJ will be mailed upon request. Mail us the coupon today.

SIMPLEX WIRE & CABLE Co

MANUFACTURERS

201 DEVONSHIRE ST. BOSTON

New York Chicago San Francisco
Cleveland Jacksonville

Simplex Wire & Cable Co.,
201 Devonshire St., Boston, Mass.

Gentlemen:
Please send data and sample of Tirex SJ Cord.

Name.....

Address.....

Title.....

Company.....

City.....State.....

Don't Make carry the

The entire expense of strengthening or extending the service facilities to accommodate the range load cannot be charged against the ranges alone—is the opinion of the Consumers Power Company of Michigan, according to *Electrical World*.

This is a very fair attitude, since the increased facilities will take care of considerable future growth in the residence load. It is obviously unfair to charge the range with any more than its share.

This problem is directly related to the sale of ranges because the installation cost is one of the sales obstacles. That the Consumers Power Company attitude is correct, is shown by the fact that from January 1, 1925, to June 1, 1926, a total of 1,082 ranges were installed in their fifteen districts. It is estimated that this will add almost two million kw.-hrs. per year to their load, amounting to about $72,000 in increased revenue.

Furthermore, this revenue just about offsets the cost of strengthening the service. The installation cost to the Company of course varies per range, but the customer is charged a uniform price within the various districts.

The experience of the Consumers Power Company shows what salesmanship and energy will do in developing the range load. It points the way to what you can do, too.

Nearly all range elements are made of CHROMEL.

HOSKINS MANUFACTURING COMPANY
4433 Lawton Avenue, DETROIT, MICHIGAN

New York *Grand Central Terminal*
Chicago *Otis Building*
Cleveland *Leader-News Building*
Boston *Park Square Building*
CANADIAN REPRESENTATIVES: Hiram Walker & Sons Metal Products, Limited, Walkerville, Ontario
San Francisco 1151 *Market Street*

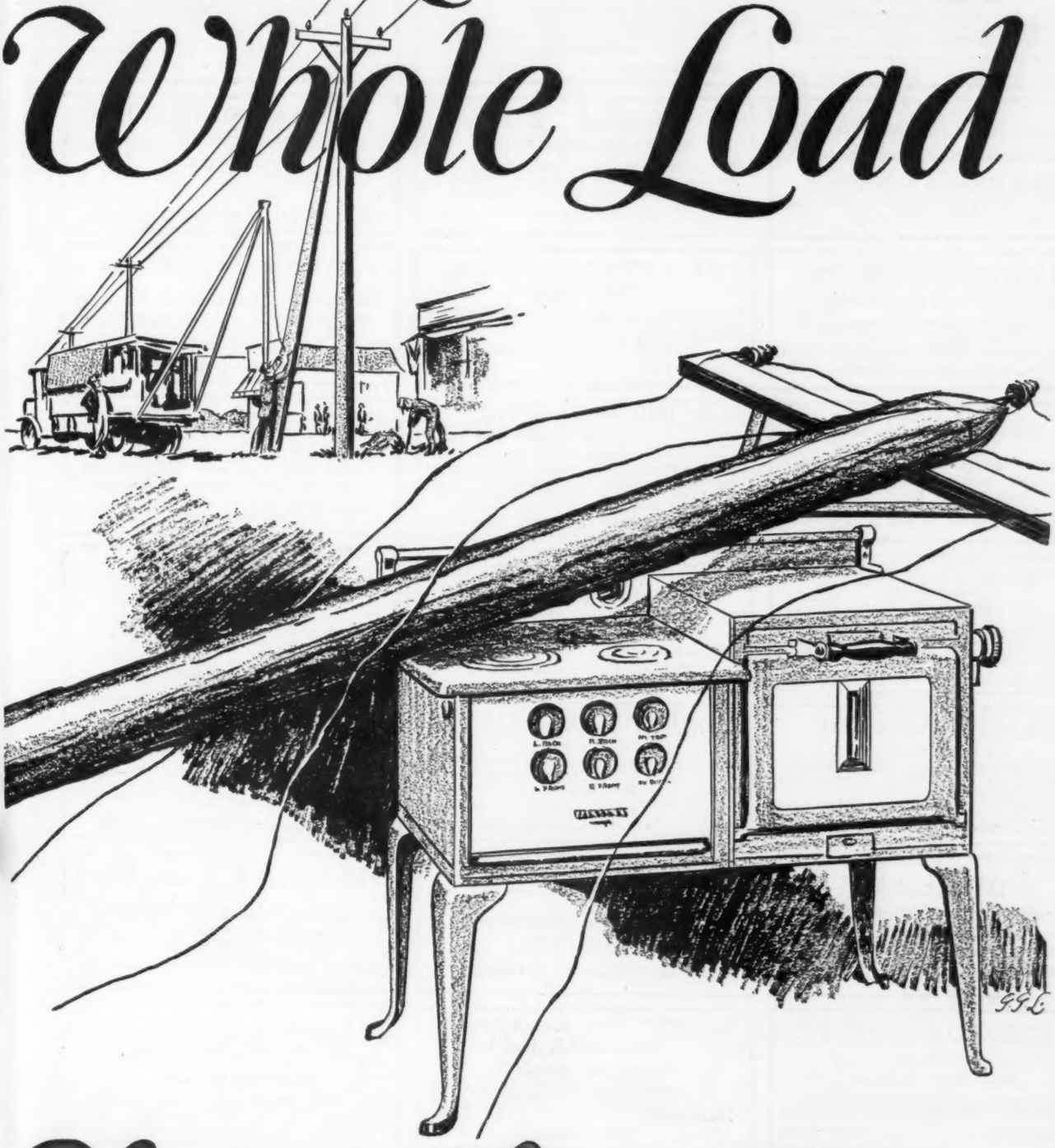
Chromel

MEANS ELECTRIC HEAT

◇ ◇ ◇ Hoskins

THE WIRE THAT MADE

the RANGE Whole Load



Chromel ◇ ◇ ◇

ELECTRIC HEAT POSSIBLE

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AMBURSEN DAMS
Hydroelectric Developments
Water Supply and Irrigation Dams
DAMS ON DIFFICULT FOUNDATIONS
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M. J. DALEY & CO., INC.
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ENGINEERS—ACCOUNTANTS—MANAGERS
Illinois Merchants Bank Building
CHICAGO

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ELECTRICAL CONSTRUCTION
Transmission and Distribution Lines, Sub-Stations and Outdoor Equipment. Expert on Steam Railroad Electrification Projects.
73 Como Ave., Buffalo, N. Y.

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Erecting Engineers
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DAY & ZIMMERMANN, Inc.
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Power Plants, Sub-Stations, Transmission Lines, Industrial Plants, Examinations and Reports, Valuations, Management of Public Utilities.
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ELECTRICAL TESTING LABORATORIES
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Tests of Electrical Machinery, Apparatus and supplies, Materials of Construction, Coal, Paper, etc. Inspection of Material and Apparatus at Manufactories.
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Incorporated
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Power Plants, Electrification Developments, Industrial Plants Railway Shops and Terminals, Design, Construction, Investigations, Appraisals.
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FARGO ENGINEERING CO.
CONSULTING ENGINEERS
Jackson, Michigan
Hydro-Electric and Steam Power Plants
Difficult Dam Foundations

WILLIAM S. LEE
Mem. Am. Soc. C. E.
Mem. Am. Soc. M. E.
Mem. Eng. Inst. Can.
Fellow Am. Inst. E. E.
Chief Engineer Southern Power Company
CONSULTING ENGINEER
511 Fifth Avenue, New York City
Charlotte, North Carolina

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Power Developments, Industrial Plants
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Public Utility Problems
For several years Division Chief with up-state New York Public Service Commission
61 BROADWAY NEW YORK

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General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.
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NEW CARDS — Cancellations and changes of copy are effective with the first issue of each month.

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Consulting Engineer
Design, Supervision, Advice, Reports, Appraisals. Industrial Plants, Substations, Power Plants, Rate Schedules and Public Utility Rate Cases. Specializing in Electric Furnace Design and Equipment.
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W. EDGAR REED
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Designer of Electrical Machinery
Estimates, Reports, Plans, Specifications and Supervision of Lighting, Railway, Industrial and Power Installations.
585 Union Arcade Bldg., Pittsburgh, Pa.

SPOONER & MERRILL
Consulting Engineers
Utility and Industrial Reports, Design, Supervision, Appraisals
425 Powers Bldg., Grand Rapids, Mich.
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ARTHUR L. MULLEGREN
CONSULTING ENGINEER
Steam and Electric Power Plants
Public Utilities
KANSAS CITY, MO.

SANDERSON & PORTER
Engineers
PUBLIC UTILITIES AND INDUSTRIALS
Design, Construction, Management
Examinations, Reports, Valuations
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Industrial Power and Illumination
Transmission Lines, Appraisals and Reports
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N. J. NEALL
Consulting Engineer
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12 PEARL STREET, BOSTON, MASS

SARGENT & LUNDY
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1412 Edison Bldg.
72 West Adams St.
Chicago, Ill.

STEVENS & WOOD
INCORPORATED
Engineers and Constructors
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YOUNGSTOWN, O.

OPHULS & HILL, Inc.
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Consulting Engineers
Ice Making and Refrigeration
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Public Utility and Industrial Plants
Design—Construction—Operation—
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PHILADELPHIA

PERCY H. THOMAS
CONSULTING ENGINEER
POWER
DESIGN, SUPERVISION, ADVICE
120 Broadway, New York City

FARLEY OSGOOD
Consultant
Design, Construction, Operation
Inter-Connection
of
PUBLIC UTILITIES
National Bank of Commerce Building
31 Nassau St., New York, N. Y.
Telephone: Rector 7878 Cable Address: Fargood

J. E. SIRRINE & COMPANY
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Textile Mills; Hydro-Electric Developments, Tobacco Products Plants; Cotton, Tobacco and General Warehousing; Industrial Housing; Steam Power Plants; Steam Utilization.
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MASA. TOMATSURI
Consulting Electrical Engineer
Specialized adviser to American Manufacturers intending to export to Great Britain and Europe.
6 Lloyd's Avenue London, E.C.3

PUBLIC SERVICE PRODUCTION COMPANY
Design and Construct: Power Plants, Transmission Lines, Industrial Plants, Highways, Railroad Shops and Terminals, Gas Plants, Commercial Buildings. Make: Examinations, Reports and Valuations.
80 Park Place, Newark, N. J.

The Directory of Engineers in ELECTRICAL WORLD is the recognized NATIONAL directory of responsible consulting electrical engineers serving the electrical field.

The J. G. White Engineering Corporation
Engineers—Constructors
Oil Refineries and Pipe Lines, Steam and Water Power Plants, Transmission Systems, Hotels, Apartments, Office and Industrial Buildings, Railroads.
43 Exchange Place New York

Advertising —

as a builder of prestige and business standing is unquestioned. It is an immeasurable power in influencing new business and retaining good-will.

Professional Cards —

in this paper offer a highly appropriate type of publicity for the services of professional men in the Electrical Field.

Your Card —

should appear in this directory regularly. If it is not there now—

CLIP AND MAIL THIS COUPON →

Professional Directory Department
ELECTRICAL WORLD
10th Ave., at 36th St., N. Y.

Gentlemen:

Please send us rates and other data for advertising in your PROFESSIONAL DIRECTORY.

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SEARCHLIGHT SECTION

USED MACHINERY & NEW—BUSINESS OPPORTUNITIES

UNDISPLAYED—RATE PER WORD:

Positions Wanted, 4 cents a word, minimum 75 cents an insertion, payable in advance.

Positions Vacant and all other classifications, 8 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of any of our offices count 10 words additional in undisplayed ads.

Discount of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

1 to 3 inches.....$5.00 an inch
4 to 7 inches..... 4.80 an inch
8 to 15 inches..... 4.60 an inch

An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

E.W.

POSITIONS VACANT

AN armature winder wanted, who is familiar with winding a.c. and d.c. motors and generators in repair shop. One dollar per hour, steady work. N. Goldschmidt & Co., 538 So. Clark St., Chicago, Ill.

SWITCHBOARD and panel board engineer and draftsman wanted by a medium sized switchboard manufacturer. Location, Pennsylvania. Prefer a man having several years directly in this line. Excellent opportunity for advancement. Give full particulars and state salary expected. P-607, Electrical World, 1600 Arch St., Phila., Pa.

WANTED several load dispatchers of several years' experience by power company in Florida. Apply by hand written letter and attach recent picture. State salary expected. P-613, Electrical World, 1600 Arch St., Philadelphia, Pa.

EMPLOYMENT SERVICE

IF YOU are qualified for position between $2,500 and $25,000, and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established sixteen years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not an employment agency. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 262 Main Street, Buffalo, N. Y.

EXECUTIVES, engineers, find our individual, confidential service effective in making new connections. Personally planned by Jacob Penn, the eminent employment authority, known to leading business men throughout America. Refund agreement protects you. Not agency. Jacob Penn, Incorporated, 305 Broadway, New York.

POSITIONS WANTED

AUDITING, office manager, treasurer, or similar position desired by young man with twelve years' continuous public utility experience these positions. Capable handling all detail and general accounting, system work, investigation work, etc. Now employed but desire change. PW-596, Electrical World, Star Bldg., St. Louis, Mo.

COMMERCIAL department manager desires connection, has handled power and lighting sales, merchandising, rate studies, public relations and advertising, some operating experience. Age 31. PW-498, Electrical World, 1600 Arch St., Philadelphia, Pa.

ELECTRICIAN, licensed, 20 years' experience on wiring maintenance and motor repair. Electrical engineer graduate, speaks Spanish and English. PW-484, Electrical World, Tenth Ave. at 36th St., New York.

"Approved"

Week after week the electrical industry writes across these pages—in the form of advertisements published—its approval of "Searchlight" Service. *And no wonder—*

The electrical man, at every stage of his career, finds advertising in the Searchlight Section of *Electrical World* a handy tool for shaping up his plans.

As a young college graduate he may secure his first employment through his own advertisement or through those of positions open. Later, by similar advertising he may secure positions of greater responsibility or more varied experience.

Eventually, as an executive, or in his own business, he may use "Searchlight" advertising to secure the skilled men he needs, to interest capital in his enterprise, to build up a selling organization, to find additional products to manufacture, to secure equipment or dispose of it, and so on, even to the point—when he is ready to retire—of selling his business or interest.

The Searchlight Section of *Electrical World* tells electrical men throughout the industry of positions vacant and wanted for skilled and professional men on operating and executive staffs, and for trained men for office and sales work, tells them also of investment, sales and purchase opportunities.

The thousands upon thousands of replies addressed to "Searchlight" advertisers measures the interest of *Electrical World's* readers in the Searchlight Section.

Advertisers' acknowledgements testify to the Searchlight Section's invaluable service in finding the right men for situations and situations for the right men, and in filling business needs that range from the sale of new inventions and patents to the disposal and purchase of going businesses.

Any service that really serves is bound to succeed. Extensive use, week after week, is the electrical industry's endorsement of *Electrical World's* "Searchlight" Service.

POSITIONS WANTED

ELECTRICIAN, 20 years' experience construction light and power, 4½ years in power station, desires power station, or industrial plant work. PW-608, Electrical World, Guardian Bldg., Cleveland, Ohio.

GRADUATE electrical engineer, age 26, desires a change. Westinghouse engineering course, two years' maintenance and construction. Position with utility or industrial concern in East or Middle West desired. PW-600, Electrical World, 7 So. Dearborn St., Chicago, Ill.

MANAGER or superintendent. Public utility executive of wide experience in rehabilitation and management of combination gas and electric properties. Can take charge of all construction work in connection with operation of properties and secure results. Technical training. Best of references. PW-610, Electrical World, 7 So. Dearborn St., Chicago, Ill.

METER engineer. Experienced in handling meter department problems. Analyzing and organizing. Desires connection with progressive organization. PW-612, Electrical World, Tenth Ave. at 36th Street, New York.

SUPERVISING appraisal engineer, university and technical graduate. Age 38. Last five years supervising appraisals of utilities. Salary $8,400.00 per year. PW-585, Electrical World, Tenth Ave. at 36th St., New York.

TECHNICAL graduate, 28 years' experience, power transmission and lighting. Past 5 years chief electrician for large South American mining corporation. Several years as draftsman and designer. Knowledge of 5 languages. Seeks position in large industrial plant, or with manufacturer. Willing to go to Latin America. PW-609, Electrical World, Tenth Ave. at 36th St., New York.

WANTED, position by superintendent with twenty-one years' experience in operation of combination gas and electric properties. Connected with one of the largest holding companies. Can give very best references. PW-581, Electrical World, Tenth Ave. at 36th St., New York.

Cost Analyst
Rate Engineer
Statistician

Available Jan. 1st, to gas or electric utility or holding group, seeking services of an engineer thoroughly qualified by education and many years' broad experience in all phases of executive engineering work.

PW-604, Electrical World
Tenth Ave. at 36th St., New York

SALESMEN WANTED

1924-5 Electrical Engineering Graduates

to be trained for sales positions; several openings exist for men of exceptional ability. The Electric Controller & Manufacturing Co., 2700 E. 79th St., Cleveland, Ohio.

Sales and Advertising Man Wanted

to become a member of manufacturer's sales department, handling preparation of sales and advertising campaigns for central station customers. Must have experience in above work, together with sales ideas and originality. Good opportunity, salary and chance for advancement with one of largest manufacturers of electrical appliances. Write for interview, giving brief outline of qualifications, salary expected, experience, present position and if possible, samples of campaigns. Location: Middlewest; there will be some travelling. SW-589, Electrical World, 7 So. Dearborn Street, Chicago, Ill.

Traveling Salesmen

for electric and railway apparatus and specialties for large sales and manufacturing company, to travel out of New York or Philadelphia. Good future for right man. Please state technical education, experience, salary and all details. Confidential. SW-616, Electrical World, 1600 Arch Street, Philadelphia, Pa.

SALESMAN AVAILABLE

ELECTRICAL engineer: Graduate electrical engineer, experienced in design and manufacture of railway signaling apparatus, two years public utility work. Open for sales engineering position with electric railway supply house. SA-567, Electrical World, 1600 Arch Street, Philadelphia, Pa.

SALES executive, 12 years' electrical and mechanical experience, power plant operation, manufacturing, advertising and publicity. Sales engineer, district sales manager. Successful record in New York and Chicago territories. SA-615 Electrical World, 7 South Dearborn St., Chicago, Ill.

EDUCATIONAL

Bliss Electrical School

Condensed course in electrical engineering. Complete in one year. For men of character, ambition and limited time. Theoretical principles and practical applications of electricity. Mathematics, steam and gas engines, mechanical drawing, extensive shop work. Construction, installation, testing. Fireproof dormitories, dining hall, laboratories, shops. Established 1893. Send for catalog. 542 Takoma Ave., Washington, D. C.

BUSINESS OPPORTUNITIES

Electrical Contracting Business

For sale. In Pennsylvania city 60,000 population. Store in center of town. Doing annual business of $75,000. Business was established 40 years ago and is the leader in its field in this community. Reason for selling owners are going into wholesale business. BO-614, Electrical World, 1600 Arch Street, Philadelphia, Pa.

For Sale—Whole or half interest in good

MOTOR REPAIR SHOP

in Oklahoma. Business shows good profit and will stand most rigid investigation. $8,000 for whole, $4,000 for half. Best opportunity for good man. Don't answer if you haven't cash.

B.O.-602, Electrical World,
7 So. Dearborn St., Chicago, Ill.

MOTOR FOR SALE

1—WESTINGHOUSE, type CW, wound rotor induction motor, 30 hp., 220 v., 3 ph., 60 cy., 1150 r.p.m., 6 poles. Rating 40 deg. C. 25 per cent O. L. 2 hrs., 55 deg. C. Furnished complete with pulley and reversible drum type controller with grid resistor moulded on pipe frame along with main line switch cabinet.

THE R. L. CARTER CO., INC.
Phoenix, N. Y.

FOR SALE or EXCHANGE

Westinghouse Generator less than half price, absolutely new, 62.5 K.V.A., 240 volts, 150 amperes, 3 phase, 60 cycle, 1200 R.P.M. Turbine-Generator - Exciter directly connected, one base.

Write for details and price.

KNOX PORCELAIN CORPORATION
Knoxville, Tenn.

Why Save It?

Equipment you have replaced, or for which you have no further use can probably be sold at a good price now. Later it may not be worth as much.

Weed out equipment and let a

"Searchlight" Ad

help you sell it promptly

G-9

Transformers

Single Phase, 60 Cycle
(all outdoor type)

1	G. E.	3	2200 to 110/220 2300 to 115/230 2400 to 120/240
5	West. 10	S	2200 to 110/220 2300 to 115/230 2400 to 120/240
1	West. 10	S	2200 to 220/110
3	West. 10	SK	6600 to 440/220
2	G. E. 37 ½H	Form K	2200 to 110/220 2300 to 115/230 2400 to 120/240
3	West. 40	S	2200 to 220/110
3	C.W.100	Form 106SC	11000 to 2300
12	A.C. 250		HV2300 and taps LV 460/230
12	West.250		2300 to 460
6	West.600		6600/2400
6	Pittsburgh 600 Kva. Self-cooled type with 4—2 ½% below normal taps on high tension, 2200 volts low tension.		

Nashville Industrial Corporation
Old Hickory, Tennessee

TRANSFORMERS AND CIRCUIT BREAKERS

2—General Electric Transformers, used but in good condition, always been in sub-station. Type HT, form SP, 60 cycles. Volts—3800—4000—4200Y 160-80. Capacity 100 kw.

8—Brand new ITE Crane Circuit Breakers, 2-pole, type W, capacity, 60-160, 45-120, 25-60, 35-90.

American Manganese Steel Co., Inc.
Chicago Heights, Ills.

BOILERS

5—823 hp. Babcock & Wilcox Stirling Water Tube, Class M-30, 200 lbs. pressure. Westinghouse stokers and all accessories.
6—400 hp. Wickes Vertical Water Tube, 160 lbs.
3—350 hp. Rust, type C 5-14.
1—300 hp. Heine Single Drum Water Tube.
1—300 hp. Vogt Water Tube.
2—200 hp. McEwen Return Tubular, 125 lbs. pressure.
2—100 hp. Ames Horizontal Return Tubular 100 lbs. pressure.
2—80 hp. Fire Tube Boilers.
Also pumps, compressors, accessories, etc.

Nashville Industrial Corporation
Old Hickory, Tennessee.

"Think SEARCHLIGHT *First"—*

To Find Men or Employment

Technical or Skilled, Plant or Office, Executive, Operative or Selling

To Locate Business Opportunities

Capital, Partners, Selling Agencies, Franchises, Contracts, Auctions, Instructions, etc.

To Sell, Rent, Exchange or Buy

Plants, Properties, Factory Buildings, Industrial Sites, Patents, Inventions or Miscellaneous Items.

0168

WANTED

WANTED

Used D. C. Watthour Meters

G. E. or Westinghouse Mfg., Type C or C-6
120 or 240 v., 2 or 3 wire

IVAN T. JOHNSON CO., INC.
24 East 23rd St., New York City

WANTED TO BUY

GENERATING UNIT

Engine and dynamo of the following description: 50 to 75 kw., 220 volt, 3 phase, 60 cycle, alternating current.

WATERLOO LAUNDRY COMPANY
Waterloo, Iowa.

J. L. HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT

801-807 Williams St. North Bergen, N. J.

Telephones: Palisade 2600-2601

MOTOR GENERATOR SETS

300 kw 250/500 v. 3 ph. 60 cy. 2300 v. Westinghouse synch. motor generator set.
1—200 kw., 600 rev., 125 v., G. E. gen. dir. conn. to 200 kw., 3 ph., 60 cy. 440 v. Westghse. synchronous motor, complete.
1—250 kw. 250 v. G. E. Generator 3 ph. 60 cy., 2200 v. synchronous motor.
1—125 kw. 250 v. Westinghouse synchronous generator motor set.
1—100 kw. 250 v. D.C. 2300/440 A.C.G.E. syn. motor generator set.
100 kw. 250 v. Gen. 900 r.p.m. 2200 synchronous motor.
1—75 kw. 250 v. Generator, 3 ph. 60 cy. 2200 v. synchronous motor.
1—50-kw. 250 volt, Westinghouse, 3 phase, 60 cycle 220/440 volts.
1—37½-kw., 900 rev.,110 v., D.C., on same base with 60- hp. Lincoln 220 v., sq. cage motor.
10-20-25-40 kw. 125 v. Exciter Sets.
10-20-30 kw. Balancer Sets.
7—4½ h.p. Battery Charging Sets.

TURBINE

1—400 kw. 3600 rev. 3 ph. 60 cy. 2300 v. Allis-Chalmers Barometric Condenser.

ENGINE GENERATOR SETS

1—200 kw. 250 v. D.C. Gen. connected to Allis-Chalmers 18x36 right hand Corliss Engine.
1—150 kw. 200 rev. 125/250 v. 3 wire G. E. engine type (generator only).
1—100 kw. 125 v. 2 wire D.C. Westinghouse R.H. gen. conn. to Harrisburg std. tand. cud. 11x18x13 engine 275 r.p.m. complete.
1—60 kva. G. E. 300 rev. 240 v. dir. conn. to Harrisburg 13x12 engine.
1—40 kw. 250 v. D.C. West-Lycoming-simple 325 r.p.m. complete.
1—30 kw. 125 v. D.C. Gen. Elec. Marine Set. 305 r.p.m.

TRANSFORMERS

3—75 kw. Maloney transformers R.E. single phase 60 cy. oil cooled indoor—2200/220-110 v. NEW

ROTARY CONVERTER

1—300 kw. 250 v. D.C. 900 rev. cpd. wound 3 phase, 60 cycle, 440 v. Westghse. Complete

A. C. GENERATORS

No.	Kw.	Rpm.	Volts	Ph.	Type
1	300	450	2300	3	G. E. P.
2	150	600	220/440/220	3	Wagner
2	100	900	2300	3	G. E.
1	75	900	2300	3	G. E.
1	50	1200	220/440	3	G. E.

A. C. MOTORS—25 CYCLE, 3 PHASE

No.	Hp.	Volts	Rpm.	Type
1	20	220/440	750	G.E. syn. A.T.I.
2	150	440	480	West. CCL

A. C. MOTORS—3 PHASE, 60 CYCLE

No.	Hp.	Rpm.	Volts	Type
1	500	360	220/440	Westg. HF. sl. rg.
1	400	450	2200	G. E. synch.
1	300	300	2200	Westghse. synch.
6	200	514	2300/440	G. E. synch.
1	180	400	440/2300	Burke sl.gr. 3 brg.
2	175	600	220/440/2200	Wagner synch.
1	150	900	2300	G. E. synch.
1	150	600	2200	Westg. sq. cage
1	150	600	2200	G. E. MT. sl.ring.
1	150	1200	220	Elec. Machy. syn.
1	75	600	220	G. E. sq. cg.
1	75	720	220	Westg., C.W.
1	75	490	440	Allis-Chal. S. R.
1	75	900	2200	G. E. KT.
1	60	1200	220	G. E. sl. rg.
1	60	900	220/440/2300	Fair.-M. Syn. Mr.
3	50	900	220	G. E. sq. cg.
1	50	900	2200	G. E. B.
1	50	1200	220/440	Wagner sl. rg.
1	40	1700	220/440	Westg. sl. rg.
1	25	1200	440	G. E. K.
1	25	900	220	West C. S.
1	7½	900	220/440	G. E. MT.
2	2	1800	220/440	G. E.

(2 *Phase Motors on request*)

D. C. GENERATORS—250 VOLT

No.	Kw.	Rpm.	Type
1	75	450	Diehl
1	50	600	Westg.
1	30	1000	Westg.

(*Smaller sizes on request*)

D. C. GENERATORS—125 VOLT

5, 10, 20, 22, 35, 50, 2-100 kw.
3—21 kw. 1250 r.p.m. Sprague

D. C. MOTORS—230 VOLT

No.	Hp.	Rpm.	Type
1	150	1100	West. SK
1	100	625	Westg. type S
1	80	500	Allis-Chalmers
2	75	475	Westg. type S
1	50	560	Westnghse SK
1	50	200	Diehl
1	50	650	Sprague
1	40	400	Diehl
1	40	1300	Diehl
1	35	200	Diehl
1	35	700	Cr. Wheeler
1	35	420	Diehl
1	30	500	Diehl
1	25	600	Sprague
1	20	665	Diehl
1	20	200	Diehl
1	20	900	Diehl
1	15	1050	Cr. Wheeler CM
1	10	375/750	Westg. S var. sp.
8	10	1350	Rochester
1	7½	1150	Sprague C
1	5	1200	G. E. RC
1	3	1200	G. E. CVC

(*Smaller sizes on request*)

D. C. MOTORS—125 VOLT

1—65 hp. General Electric Type CL 550/605 motor.

3	25	1200	Sprague
1	20	650	G. E.
1	15	775	SK Westg.
1	5	700	Diehl
3	3	1100	G. E.
2	3	1700	G. E.

Special Bargain Offering

3 Phase, 25 Cycle, 550 Volt Motors

Qu.	H.P.	Make	Type	R.p.m.	Price, Each
1—	25	G.E.	1-K	1455	$125.00
1—	30	A.C.	2-K	715	140.00
5—	35	G.E.	1-K	715	160.00
2—	50	G.E.	1-K	715	200.00
7—	75	G.E.	1-K	715	275.00
1—	75	G.E.	ITC	715	450.00
2—	100	G.E.	1-K	715	300.00
1—	50	G.E.	1-K	715	325.00

1—50 Kw. Motor Generator Set, 75 HP., G.E., 1-K motor direct connected to 50 Kw., G.E. RMC Generator, 250 volt, D.C., 1,455 r.p.m. with compensator and rheostat.....$550.00

1—50 Kw. Synchronous Motor Generator Set, 75 Kw. modern G.E. synchronous motor having direct connected exciter and direct connected to 50 Kw., G.E., RC type generator, 250 volt, 715 r.p.m. with compensator and rheostat...$900.00

All the above is in good used condition as removed from operation, none burned out. Prices are f.o.b. Pennsylvania and include starting equipment, also in most cases bases and pulleys. Immediate shipment.

This is your opportunity

R. SCHEINERT COMPANY

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BARGAINS

Priced to Sell Quickly

GUARANTEED

2—25 K.W. 250 volt D.C., 325 r.p.m., Westinghouse Generator, direct connected to Erie center crank engine with switchboard.

1—30 K.W. 550 V. D.C. Westinghouse 3 ph., 60 cy., 2200/440/220 V. A.C. Sq. Cage, 1200 r.p.m. Motor Generator Set.

1—75 K.W. 125 V. D.C. Allis-Chalmers 3 ph., 60 cy., 2200/440/220 V. A.C. 900 r.p.m. Synchronous Motor Generator Set.

1—435 HP., 3 ph., 60 cy., 2200 volt General Electric Co. 450 r.p.m. Synchronous motor type ATI, form B, with exciter, compensator, etc.

3—100 KVA. Wagner Elec. Corp., 1 ph., 60 cy., type ROB transformers, pri. volts, 4600/4370/4170 secondary 230/115 volts.

1—Clyde Iron Works single friction drum 16x20 in. hoist with 25 H.P., 550 volt, D.C. Westinghouse K-7 series wound motor, electric brake, drum controller and resistors.

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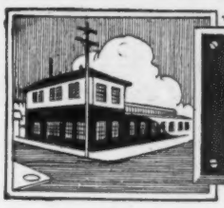

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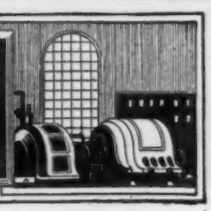

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New and Used Electrical Equipment—Condition Guaranteed—Ready to Ship

Slip Ring Motors—3-phase, 60-Cycle

Hp.	Volts	Speed	Make	Type
200	220–440	600	Westinghouse	CW
150	2200	600	General Electric	M
150	550	600	General Electric	M
150	220/440	600	General Electric	M
150	220/440	720	General Electric	M
125	440/220	720	General Electric	M
100	2200	600	General Electric	M
100	2200	720	General Electric	M
100	440/220	720	General Electric	M
100	550	720	General Electric	M
100	440–220	600	General Electric	MT
75	220–440	900	General Electric	M
75	550	900	General Electric	M
75	2200	720	General Electric	M
75	440/220	720	General Electric	MT
60	550	720	General Electric	MT
60	2200	600	General Electric	M
50	440/220	514	General Electric	M
50	550	900	General Electric	M
50	440/220	900	General Electric	M
50	440–220	600	General Electric	MT
50	2200	600	General Electric	MT
35	440/220	900	General Electric	M
35	550	900	General Electric	M
25	220–440	900	General Electric	MT
20	220/440	900	General Electric	M
15	220/440	1200	General Electric	MT
15	220–440	900	Westinghouse	CW
10	220–440	1200	General Electric	MT

DIRECT CURRENT MOTORS

175	115	575	Crocker-Wheeler	Interpole
125	230	545	Crocker-Wheeler	H
55	115	845	General Electric	CLB
50	115	750	Westinghouse	SK
40	220	550	Allis Chalmers	
35	220	575	Westinghouse	S
35	550	825	General Electric	DLC
30	220	575	Westinghouse	S
30	230	1150	General Electric	RC
25	230	1150	General Electric	RC

Squirrel Cage—3-phase, 60-Cycle Motors

150	2200/440	720	General Electric	K
125	2200/440	720	General Electric	K
100	220/440	1200	General Electric	KT
100	550	900	General Electric	KT
100	440/220	720	General Electric	K
100	440–220	900	General Electric	K
75	440/220	600	General Electric	K
75	440/220	720	General Electric	K
75	2200	900	General Electric	K
60	2200	900	General Electric	KT
60	440/220	720	General Electric	KT
50	440/220	900	General Electric	K
50	220/440	1200	General Electric	K
40	220/440	1200	General Electric	KT
40	550	900	General Electric	KT
40	440/220	900	General Electric	KT
35	550	900	General Electric	K
35	220/440	900	General Electric	K
30	220/440	1200	General Electric	KT
30	550	1200	General Electric	KT
25	2200	1200	General Electric	KT
25	220/440	1200	General Electric	KT
25	440/220	900	General Electric	KT
20	220/440	900	General Electric	K
20	2200	900	General Electric	KT
15	220/440	900	General Electric	K

DIRECT CURRENT GENERATORS

Kw.	Volts	Speed	Make	Type
200	125	600	Crocker-Wheeler	Interpole
90	125	1150	General Electric	RC
50	125	850	Westinghouse	SK
45	125	975	General Electric	CLB
12	250	600	Westinghouse	SK
6	125	300	Westinghouse	SK

TRANSFORMERS

3—General Electric type H, form KDD, 100 kva., 6600–13,200 volt primary, 230–460 volt secondary, single phase, 60 cycle.

MOTOR GENERATOR SETS

1—220-kw., 250-v., 514-r.p.m., Westinghouse D.C. Generator connected to 300-kva., 2200-volt, 3-ph., 60-cy., Westinghouse syn. motor.

1—75-kw., 125-volt, 900-r.p.m., General Electric Type DLC, Generator connected to 110-hp., 220/440-volt., 3-ph., 60-cy., General Electric Form K motor.

ALTERNATING CURRENT GENERATORS

1—150-kw., 600-r.p.m., 2300-volt, 3-ph., 60-cy. General Electric type ATB with belted exciter.

2—135 Kva., 900 r.p.m., 2300/440 volt, 3 ph., 60-cy., General Electric type TRC with belted exciter.

TURBO-GENERATORS

1—500-kw., Westinghouse, 2300/550/440-volt, 3600-r.p.m., 3-ph., 60-cy. turbo-generator, with barometric condenser.

1—125-Kva., 240/480/550-v., 3-ph., 60-cy., 900 r.p.m., Westinghouse A.C. Generator with direct connected exciter, geared to Westinghouse non-condensing 7200 r.p.m. turbine.

1—35-kw. Westinghouse, 125/250-v., D. C., 1200 r.p.m., 3-wire, connected to 7200 r.p.m. Westinghouse geared turbine.

ENGINE GENERATOR SETS

1—75-kw., 250-125-v., 265 r.p.m., 3-wire Westinghouse connected to 13x12 Harrisburg Engine.

1—50-kw., 2380/440/220-volt, 300-r.p.m., 3-ph., 60-cy., General Electric Generator, direct connected to 11 x 12 Ames side-crank engine.

1—37 ½-kw., 125-volt, 300-r.p.m., Westinghouse D.C. Generator direct connected to 10x10 Harrisburg engine.

1—30-kw., 250-volt, 300 r.p.m. General Electric D.C. Generator direct connected to 10x10 Ames center crank engine.

If your requirements are not listed, write us, as we do not attempt to list our entire stock.

TRANSFORMERS

60 CYCLE

2—2800 kva. Gen. Elec. 3 ph., 30000/60000 vs. prim. 2300 vs. secy.
3—1550 kva. Gen. Elec. single phase, 46000/44000/42000/20100/19100/18100 vs. prim. 2300/2200/2100 vs. secy., O.I.W.C.
3—1000 kva. Westgh. 6600 vs. prim. to 2200 vs. secy.
3—667 kva. Pittsburgh 66000 vs. prim. to 22000 volts secy.
3—500 kva. Westinghouse OISC. Outdoor 22000 vs. prim.—2300 vs. secy.
3—500 kva. Gen. Elec. OISC, type H, 11000/10725/10450/10175 vs. prim to 2400/2200 vs. secy.
3—400 kva. Ft. Wayne 11000 vs. prim. to 220/440 vs. secy.
3—333 kva. Fort Wayne, General Electric, type H, 13200/6600 vs. prim. with taps for 12870/12540/12210/11880—to 2300/4000 vs. secy.
3—333 kva. Gen. Elec. 33000 volts prim. to 2300/4000 Y. secy.
3—250 kva. Gen. Elec. 2300 vs. prim. 230/460 vs. secy.
3—200 kva. Gen. Elec. type H., 13800 vs. prim. to 230/460 vs. secy.
3—150 kva. Gen. Elec. 11000/22000 vs. prim. to 550/2200 vs. secy.
3—150 kva. Gen. Elec. 2200 vs. prim. to 120/240 vs. secy.
3—100 kva. Pittsburgh 13800 vs. prim. to 115/230 vs. secy.
3—100 kva. Westgh. type SK, 11000 vs. prim. to 110/220 vs. secy.
3—100 kva. Gen. Elec. type H. 13800 vs. prim. to 230/460 vs. secy.
3—100 kva. Al. Chal. 2200 vs. prim. 240/480 vs. secy.

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MOTOR BARGAINS

New and Used Selected Bargains

SLIP RING MOTORS

Hp.	Make	Ph.	Cy.	Volts	Rpm.
300	Allis-Chal.	3	60	220/440	870
200	Fair.-Morse	3	60	220/440	600

Others down to ½ hp.

SQUIRREL CAGE MOTORS

150	G.E.	3	25	440	375
150	G.E. (K.T.)	3	60	2200	870

Others down to ½ hp.

DIRECT CURRENT MOTORS

Hp.	Make	Speed
120	Sprague (C.)	450/900
100	Sprague (C.)	550/1100

Others down to ½ hp.

Large stock of Motors from ¼ to 300 hp. Also Generators and Motor Generator Sets of all characteristics.

L. J. LAND, 207 Centre St., N. Y. C.

The ELECTRIC SERVICE CO. Inc.

America's Used Transformer Clearing House

212 Walnut Street Cincinnati, Ohio

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We carry a stock of approximately 2000 transformers of a total capacity of about 85,000 kva., in sizes from 1 to 1000 kva. and from 110 volts to 66,000 volts.

We specialize in the rewinding and repair of transformers, any size and any specifications. All work positively the best and guaranteed as such. We will show you a saving of from 30% to 60% of the cost of new transformers!

Send for our monthly bulletin, showing complete lists of transformers on hand, and our prices for rewinding transformers.

WE BUY MODERN TYPE TRANSFORMERS—ANY SIZE—ANY QUANTITY

MOTORS

20 H. P. to 75 H. P.

3 Phase—60 Cycle

Squirrel Cage and Slip Ring

These motors are General Electric and other standard makes. The majority are new and in original crates. Priced materially below present-day cost for we desire to liquidate them within the next 90 days.

FREQUENCY CHANGERS

25 to 60 Cycle

3—500 kva., General Electric Generators, 2400 volt, 62½ cycle. Motor 6600 volt, 25 cycle.

ROTARY CONVERTERS

General Electric, 125-250 volt D.C., 25 cycle on A.C. side.

2—400 kw., 2—750 kw., 2—1500 kw., 2—2000 kw.

CABLE

Immediate Delivery at Material Saving

Size	Condr.	Volt	Size	Condr.	Volt
6	2	600	10	2	5,000
2	3	600	6	1	6,600
6	1	2,500	10	6	10,000
6	1	2,500	6	1	10,000
3/0	1	2,500	6	8	10,000
6	4	4,500	3/0	1	13,200
3/0	1	4,500	3/0	1	13,200

PUMPS

1—DeLaval, 35-ft. head, 500 GPM.
1—Platt, 400-ft. head, 300 GPM.
1—Platt, 240-ft. head, 700 GPM.
1—Platt, 160-ft. head, 400 GPM.
1—Platt, 65-ft. head, 1600 GPM.
1—Platt, 35-ft. head, 2400 GPM.
1—Platt, 40-ft. head, 1200 GPM.
1—Platt, 20-ft. head, 1900 GPM.
1—24-in. Worthington Drainage Pump, 15-ft head, 20,000 GPM.
2—100-hp. Worthingtons with Generators.

Complete stock of equipment for distribution systems and industrial plants.

Address, Attention W. C. Blair, Industrial Engineer

Kansas City Power & Light Co.

1332 Grand Avenue,
Kansas City, Mo.

MOTORS

Three Phase, 60 Cycle

Qu.	Make	H.P.	Type	Volt	Speed
1	G. E.	7½	KT	440	1200
2*	G. E.	7½	1-8 Form M	440	900
25	A. C.	7½	13D-117-613-IV	440	1200
1*	G. E.	15	I-10 Form M	440	720
1*	G. E.	15	I Form M	220	900
15	West.	30	CS	440	1200
1	A. C.	15	17K18	440	800
3	G. E.	30	KT332 Form B	440	1200
2*x	West.	40	CW	440	1200
1*x	G. E.	40	MT 356Y	440	1200
15*x	G. E.	40	MT 336Y	440	1200
1	West.	75	CS	440	1800
6	G. E.	75	I	440	720
1	West.	150	CS I 792 74B	2200	1800
1	G. E.	300	I Form K	2200	1200

Above motors squirrel cage with exception of those marked *, which are slip ring. Motors marked *x are vertical.

Starting compensator having no voltage releas and overload relays furnished with motors 7½ H.P. and above. Controls and resistance furnished with slip ring motors. Automatic remote control with 40 and 50 H.P. slip ring motors.

Nashville Industrial Corporation
Old Hickory, Tennessee

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250 kva., 220-440-2200 volts G. E. 3 ph., 60 cy. and Chuse Uniflow Engine.
150 kw., 125-250 volts, 3 wire G. E. Type LDS and Erie City Corliss Valve Engine.

Other Units. All Sizes.

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Boilers—Cranes—Motors—Compressors

USED MOTORS and Generators

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4—300-hp., Allis-Chalmers, 3 phase, 60 cycle, 220-240 volts, 1750 r.p.m.

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HAS FOR SALE

1—500 H.P. Electric Machinery Co., 3 phase, 60 cycle, 440 volts, 360 R.P.M., 30 deg. temperature rise, three bearing **Synchronous motor** with **base, pulley, 42x43, exciter** and **switchboard** for starting.

1—220 K.W. General Electric type H.C.C. **Rotary Converter,** three wire D.C. 125-250 volts, 1200 R.P.M. with 3-single phase **transformers** for 2300 volts primary complete with **switchboard.** Both outfits only used for a few years and big bargains.

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Used and **Rebuilt Engine Generator Sets, Turbo Generator Sets, Motors, Rotary Converters, Generators, Motor Generator Sets, Engines, Boilers, Steam and Electric Machinery** of all kinds, also **Machine Tools.** Send for our new machinery list. Yours for the asking.

The RANDLE MACHINERY CO.
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3 PH. 60 CY. SLIP RING MOTORS

2—100 hp., 900 r.p.m., General Electric.
1— 75 hp., 900 r.p.m., General Electric
1— 75 hp., 1200 r.p.m., General Electric.
1— 75 hp., 720 r.p.m., General Electric.
1— 30 hp., 1150 r.p.m., Westinghouse.

Complete with accessories. 220 or 440 volts.

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GENERATOR SETS

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3,000 kw., Westinghouse, 3-60-2200
2,500 kw., Gen. Elec., 3-60-6600
1,500 kw., Gen. Elec., 3-60-2200
1,000 kw., Allis-Chalmers, 3-60-2200
500 kw., Allis-Chalmers, 3-60-2200
250 kw., Allis Terry, 3-60-2400
100 kw., Gen. Elec., 3-60-600
75 kw., G. E.-Terry Dual Exciter 125 v.
250 kw., Diehl-Kerr, 125 v. D.C. NEW

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10—600 hp. B&W Straight Tube Boilers six to nine years old, 200 lb. steam pressure ASME Std. with 100° superheat and underfeedd stokers with all trimmings as operated.
4—150 hp. Dillon HRT, 125 lbs. Mass. Std.

CONVERTERS

1,800 kw., Gen. Electric, 3-25-2300-600 v.
1,250 kw., Gen. Electric, 3-60-4150/11,000-280 v.
2—300 kw., Allis, NEW, 3-60-4100/250 v.
220 kw. G.E. 3-60-2300-125/250

M. G. SETS

220 kw., West. Syn., 3-60-2200-250 v.
2—150 kw., West., Syn., 3-60-6600-2200-250 v.
75 kw., G. E., 3-60-2200/125 v.
50 kw., Westinghouse, 3-60-2200/125 v.

TRANSFORMERS

3—4167 kva., Gen. Electric, 1-60-12,000/2300
2—450 kva., Pitts., 3-60-13800/460-230
6—333 kva., Pitts., 1-60-13800/6900/4100-2200 v.

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Boston, Mass.

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A.C., 60-cycle, 3-phase, 220- or 440-volt.

1—100 hp. Westinghouse
1—100 hp. Allis-Chalmers
1— 75 hp. General Electric
1— 50 hp. General Electric
1— 25 hp. Allis-Chalmers—Slip Ring.

In Small Motors, we have on our floors over one hundred, and solicit the opportunity to quote on the motor you require.

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Fort Wayne, Indiana

STEAM TURBOS

15000 - 9375 - 4000 - 3750
3125-2500-1875-1250 Kva.
2500—KVA. BLEEDER TYPE
2—New 625 kva. with Condensers.
All above 60 cy. 3 ph.
CRANES—CRANES—CRANES
2—New 1001 hp. Boilers
ASME CODE 200-lb. Never Erected.
Trans. M. G. Sets and Large Motors.
ROSS POWER EQUIP. CO.
Indianapolis, Ind.

Generator Set

1—G. E. Type MP No. 33685 Class 4-9-1450, form H, 125 volt, 75 amp., 1450 r.p.m. direct current generator, with Wheland 8x10-in. plain slide valve horizontal center crank steam engine, 54x8-in. solid cast iron flywheel, belted, fly ball governor, 24x10-in. solid cast iron pulley. Also switchboard and accessories.

Nashville Industrial Corporation
Old Hickory, Tennessee

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800 kw., 440 volt, Allis-Chalmers, belted.
635 kw., 440 volt, General Electric to Rice & Sargent engine.
500 kw., 2300 volt, to Ridgway, 4 valve engine.
300 kw., 2300 volt, General Electric, belted.
300 kw., 2300 volt, General Electric to Harrisburg, 4 valve.
200 kw., 2300 volt, Westinghouse, belted.
192 kw., 2300 volt, General Electric to Skinner uniflow.
185 kw., 2300 volt, General Electric to Skinner uniflow.
150 kw., 220 volt, General Electric to Ames.
125 kva., 2300 volt, Allis-Chalmers to Harrisburg.
50 kva., 480 volt, Crocker-Wheeler to Ames.

Very Large Stock Transformers, Turbines, Engine Driven Units, Motor Generators, Motors, Dynamos, All Descriptions.

GEORGE SACHSENMAIER CO.
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SLIP RING MOTORS

220/440 Volt, 60 Cycle

1—150 hp. Westing., Type CW, 3 ph., 700 r.p.m.
1—50 hp. Gen. Elec. Type MIS, 3 ph., 1200 r.p.m.
1—40 hp. Wagner Elec. Type BR, 2 ph., 1140 r.p.m.
1—40 hp. G.E., Form Vertical, 3 ph., 1160 r.p.m.
1—35 hp. Westing., Type CI, 3 ph., 850 r.p.m.
1—35 hp. Lincoln, unused, Type H and J, 2 ph., 900 r.p.m.
2—30 hp. Westing., Type CI, 3 ph., 855 r.p.m.
1—30 hp. Westinghouse Type HF, 2 ph. 1700 r.p.m.
1—20 hp. Westinghouse Type HF, 3 ph., 1120 r.p.m.
1—11 hp. Westing., Type CI, 3 ph., 1135 r.p.m.
1—10 hp. G.E., New, Type MT, 3 ph., 1140 r.p.m.
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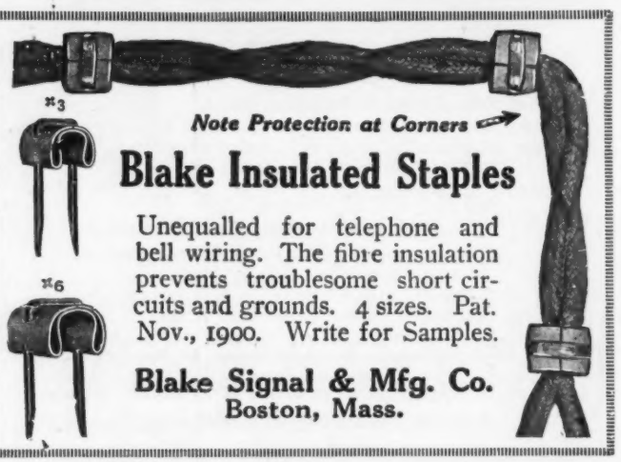

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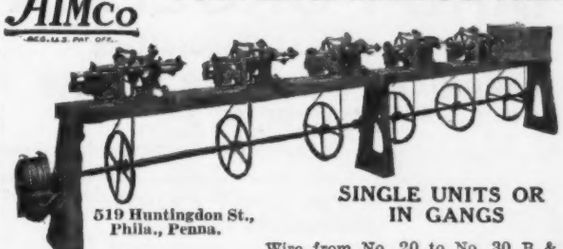

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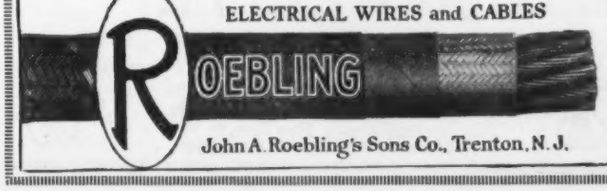

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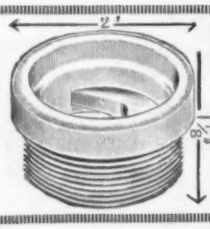

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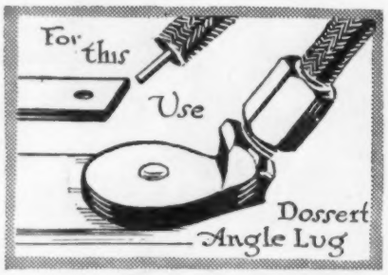

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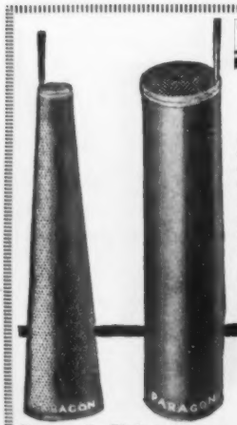

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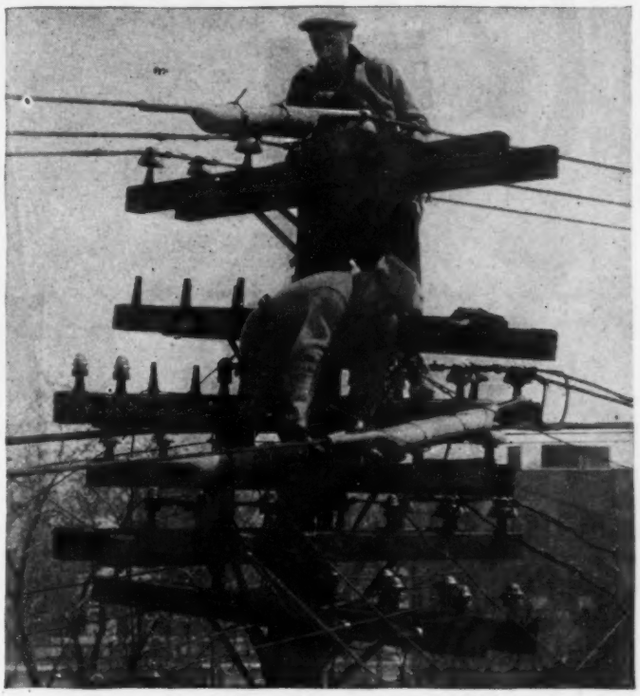

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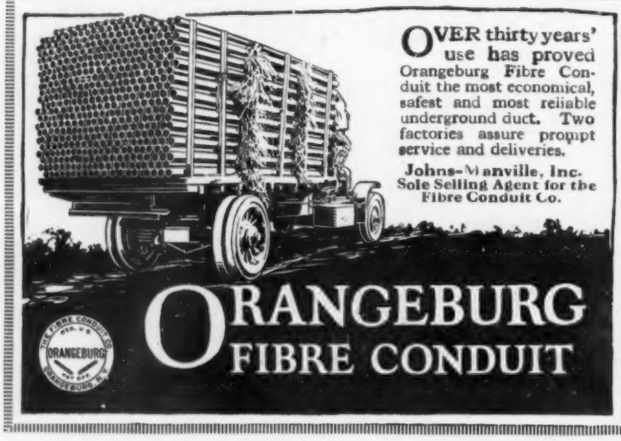

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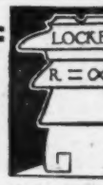

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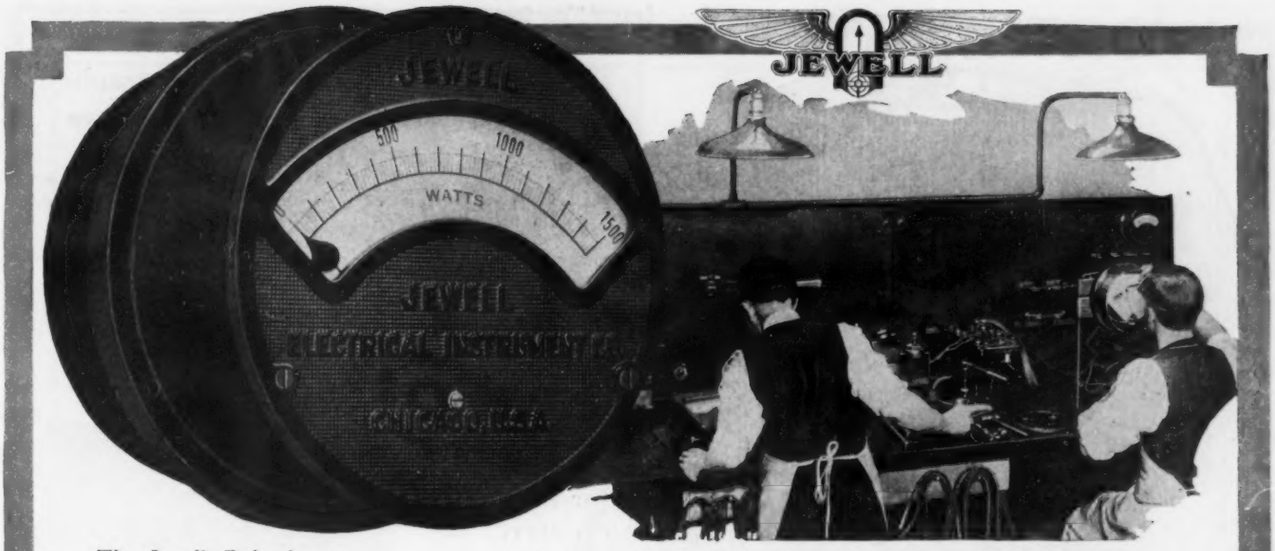

The Jewell Polyphase Wattmeter is of the dynamometer type and employs two full size movements on a single shaft. The separate movements are accurately calibrated and the movements are balanced as a whole so the indications are accurate under all conditions.

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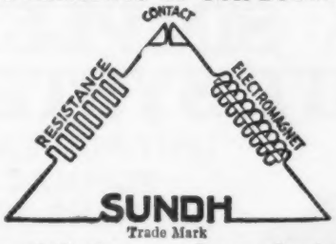

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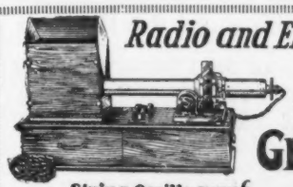

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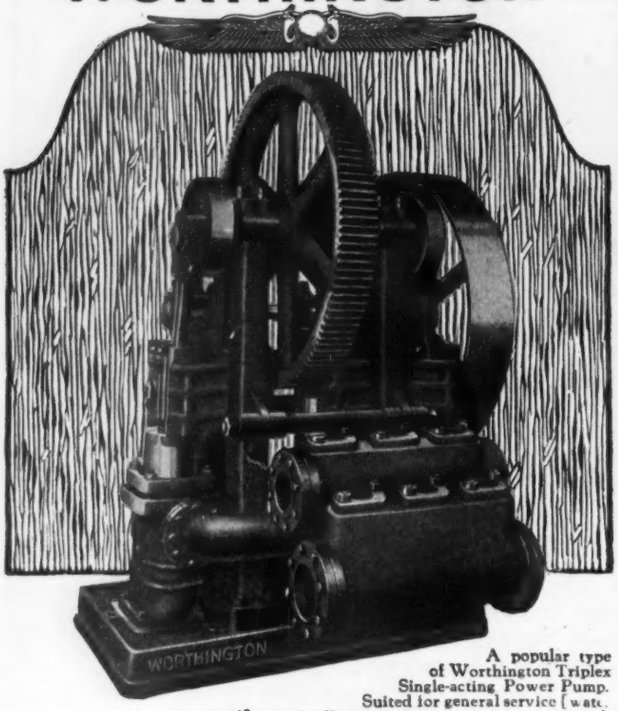

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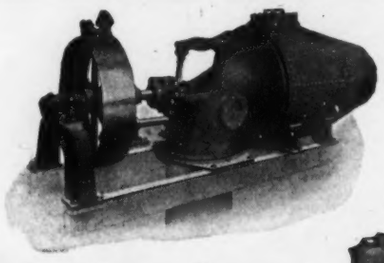

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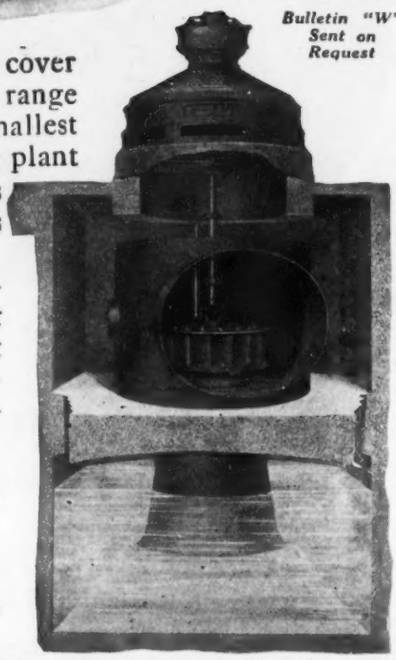

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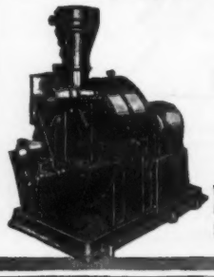

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As information to executives who may not know—and as a reminder to those who may have forgotten—a series of "Be Sure" articles are being published in this space.

No. 7 will follow in an early issue. Reprints of the previous numbers will be mailed on request.

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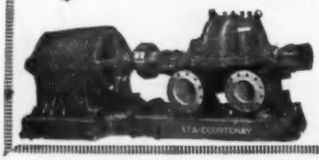

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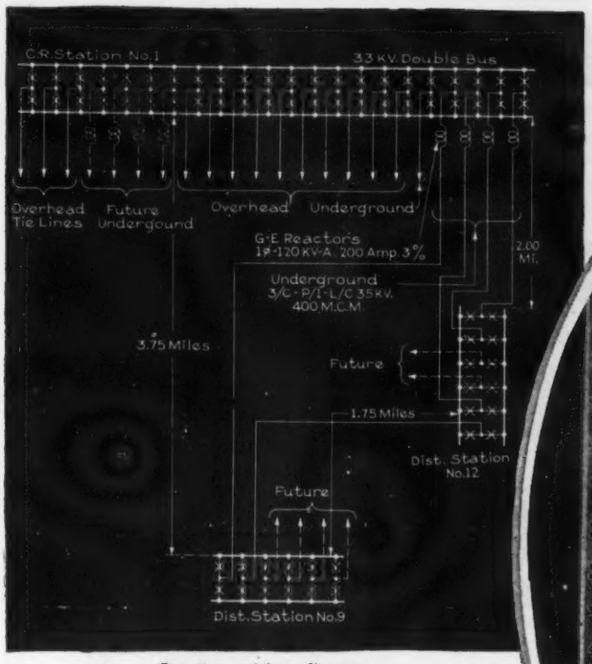
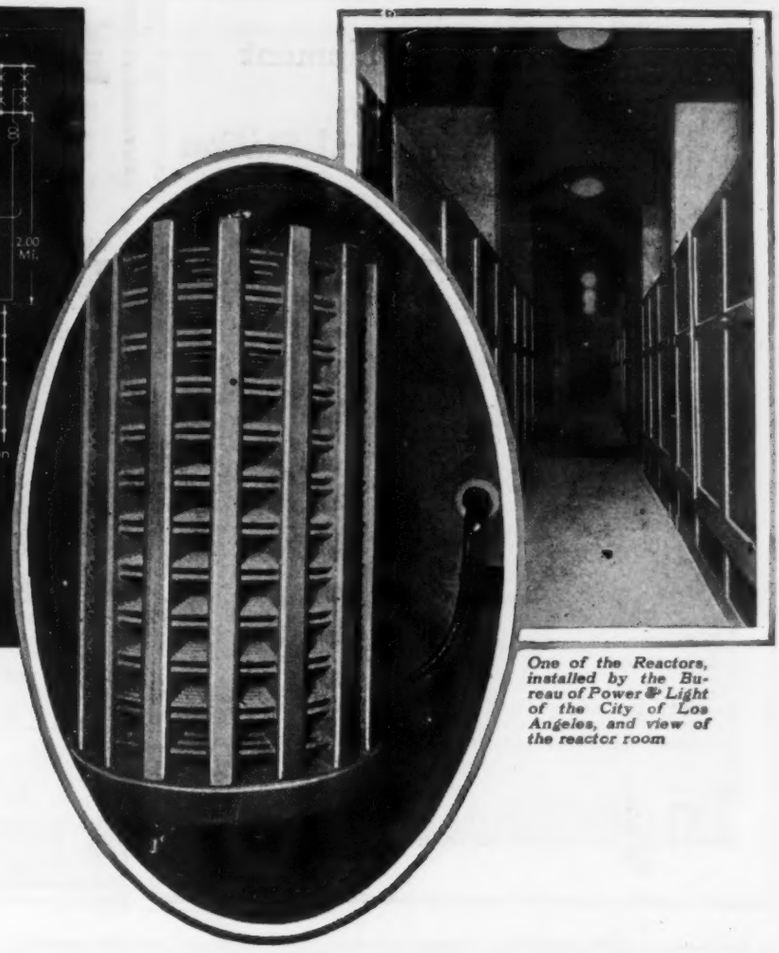


One-line wiring diagram of 33-kv. feeders with G-E Current Limiting Reactors



One of the Reactors, installed by the Bureau of Power & Light of the City of Los Angeles, and view of the reactor room

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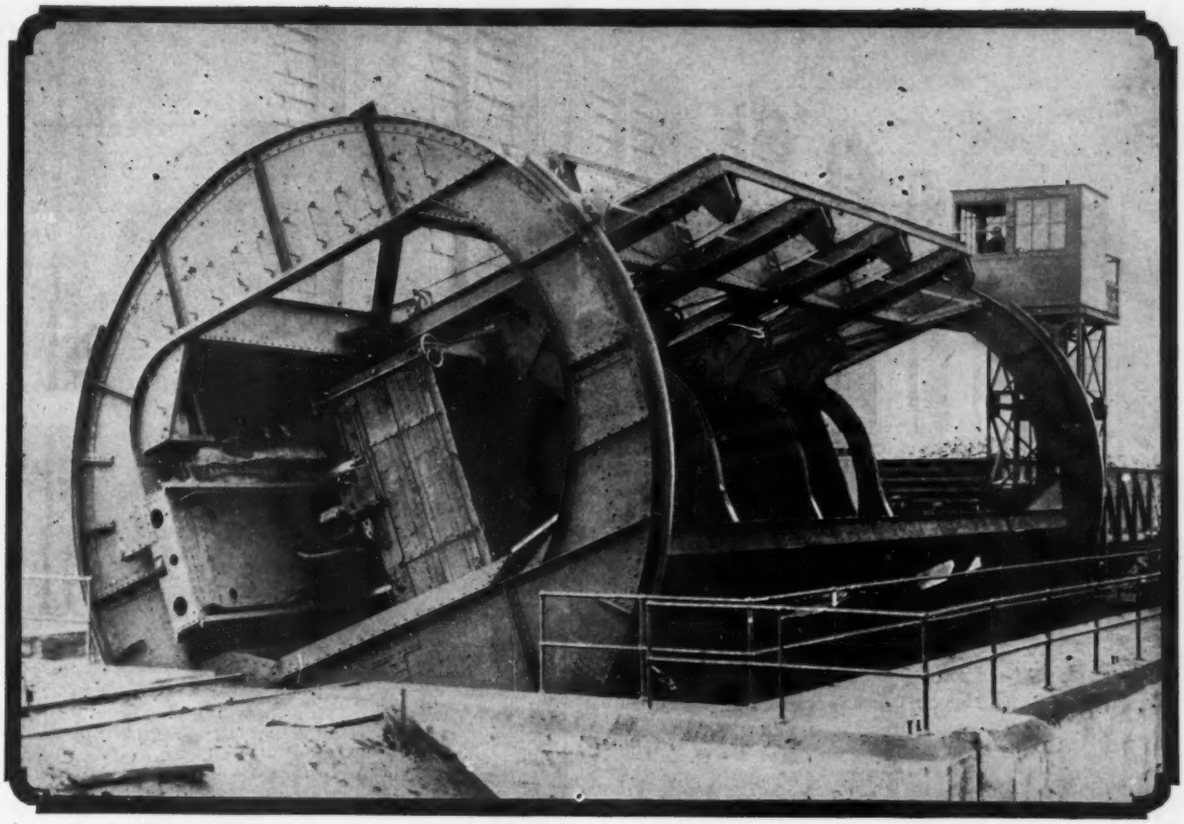

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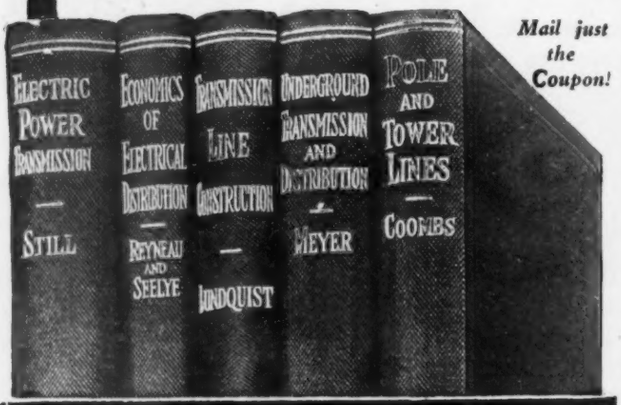

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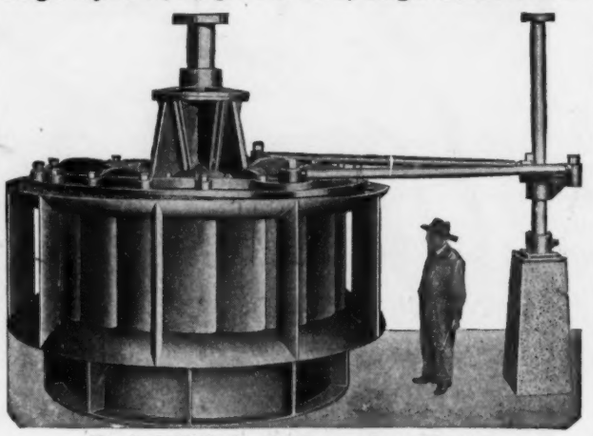

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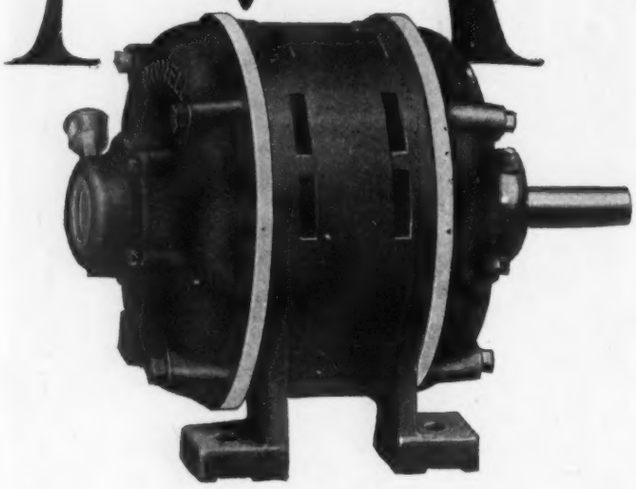

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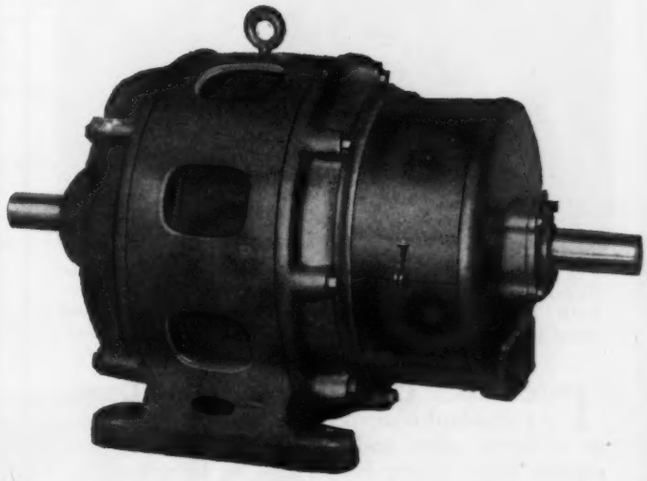

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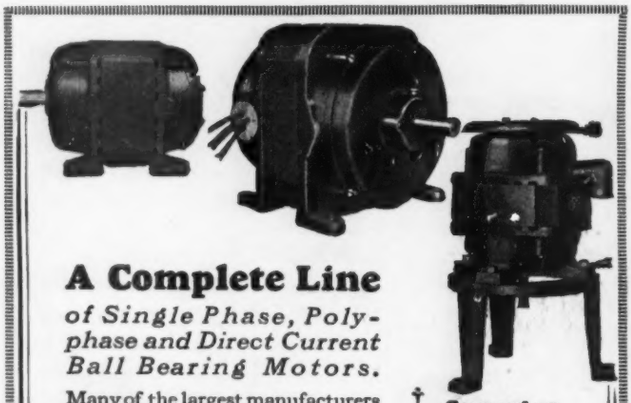

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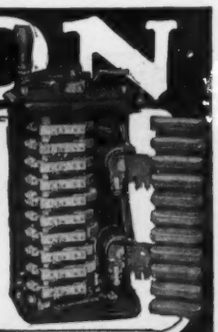

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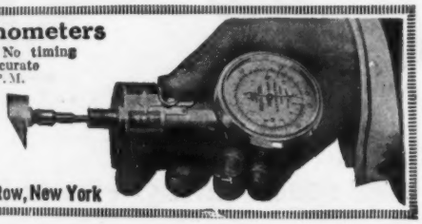

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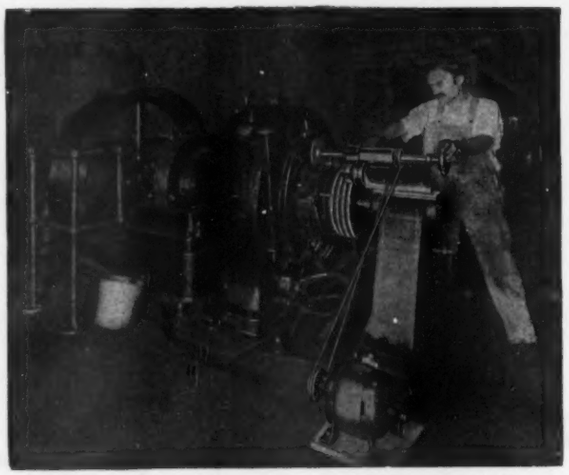

The above illustration shows a 75-KW. Westinghouse Generator being trued with the JORDAN COMMUTATOR TRUING DEVICE, machine running at normal speed while under load.

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I-C

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Oil Immersed
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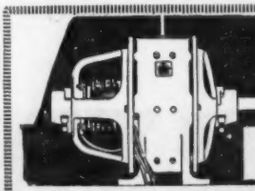

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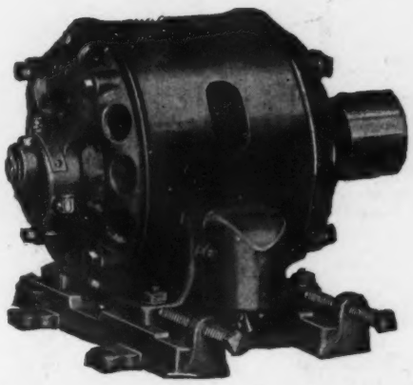

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There *is* a Difference

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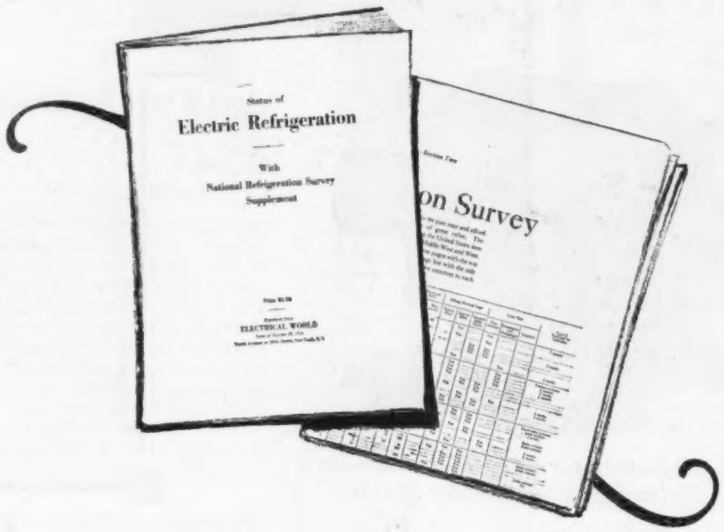

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Cutler-Hammer Automatic Sub-station Controller at the Northumberland Mining Company's mine at Excelsior, Pa.

Find the attendant!

THE attendant for this sub-station is here alright. He is on the job 24 hours a day, seven days a week—but he's not on the pay-roll.

The attendant is the Cutler-Hammer Automatic Sub-Station Controller mounted on the panel at the right. The 3 phase, A.C., motor is started and accelerated automatically and is protected by phase failure, low-voltage and overload relays. The opening and closing of the circuit breaker on the D. C. side also occurs automatically and protects the generator from overload.

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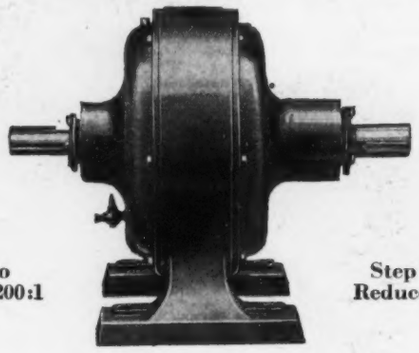

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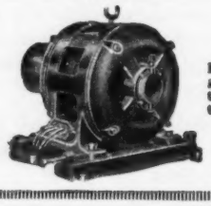

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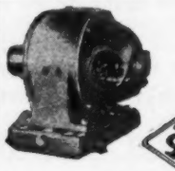

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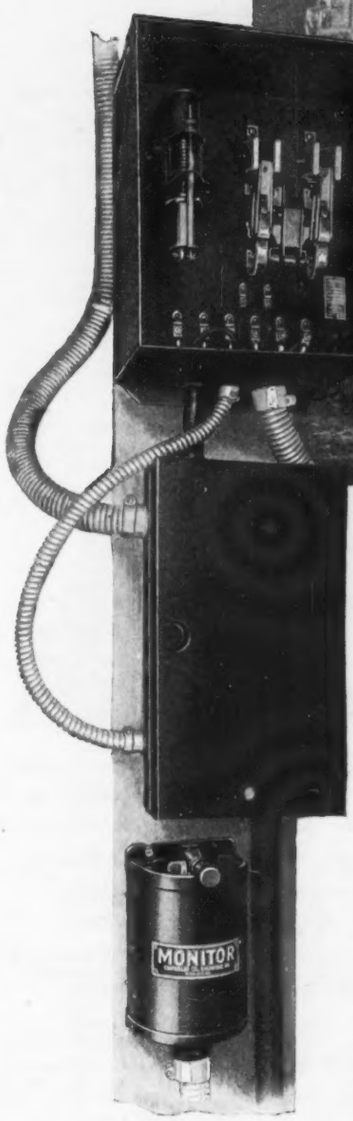
620

Monitor controlled all-steel balers in plant of Buffalo Waste Paper Company, Buffalo, N. Y.



Close up view of Monitor Controller for paper baler showing the overload relay — the little brain that governs the motor.

Mighty stresses—

controlled by a little mechanical brain

AS THE plungers of these large all-steel paper balers descend, machine stresses and the load on the driving motors become greater and greater. At some pre-determined pressure the process of compression must be stopped — otherwise the press or its motor might be damaged.

To insure the stopping of the press at the proper time, a little mechanical brain — a Monitor Automatic Controller — is used. An overload relay on the control panel automatically opens the circuit when the pressure reaches a certain pre-determined value — changeable at will.

Similarly, on reverse, the controller automatically stops the motor after the plunger has ascended and swung itself to the side.

All that the operator — who may be an unskilled laborer — has to do is to start the plunger on its downwards or upwards travel — Monitor Automatic control doing the rest. A latch on the drum controller prevents the operator from throwing the lever quickly from one operating direction to the other — thus protecting the motor against sudden reversal.

In practically every industry, on thousands of machines, Monitor Automatic Controllers act as little brains for the driving motors — performing their duties with greater certainty and precision than possible with manual control. In hundreds of cases, added advantages are safety to machine operators, improved quality of product and greater production. Let us tell you more about the Monitor system — ask for Bulletin 10-100.

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Readers interested in any articles not listed in these pages are cordially invited to inform us of their wants and every effort will be made to put them in touch with the proper manufacturers.

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Manufactured and guaranteed by

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Westinghouse Elec. & Mfg. Co.

Generators
Allis-Chalmers Mfg. Co.
American Brown Boveri Elec. Corp.
Belt Driven
Westinghouse Elec. & Mfg. Co.
Engine Driven
Westinghouse Elec. & Mfg. Co.
Motor
American Brown Boveri Elec. Corp.
Steam
Combustion Engr. Corp.
Turbo
American Brown Boveri Elec. Corp.
Waterwheel
American Brown Boveri Elec. Corp.
Waterwheel Driven
Westinghouse Elec. & Mfg. Co.

Governors, Water Wheel
Mechanical
Woodward Governor Co.
Hydraulic
Woodward Governor Co.

Grates, Furnace
Furnace Engineering Co., Inc.

Ground Caps
G. & W. Elec. Spec. Co.

Grounds, Etc.
Paragon Electric Co.

Guards, Lamp
Matthews Corp., W. N.

Hangers, Ball Bearing
S K F Industries

Hangers, Cable
Hubbard & Co.

Heaters
Feed Water
Bethlehem Steel Co.
Worthington Pump & Machy. Corp.
Oil
Power Specialty Co.

Heaters for Special Purposes
Power Specialty Co.

Heating Devices
Cutler-Hammer Mfg. Co.
General Electric Co.
Graybar Electric Co.
Westinghouse Elec. & Mfg. Co.

Hoists
Electrical
Allis-Chalmers Mfg. Co.
American Engineering Co.
Lipe, Inc., W. C.
Head Gate
S. Morgan Smith Co.
Steam
Allis-Chalmers Mfg. Co.

Indicators, Speed
(See Tachometers)

Indicators, Transformer Load
Westinghouse Elec. & Mfg. Co.

Instrument Transformers
General Electric Co.

Instruments
Boiler Room
General Electric Co.
Electrical
General Electric Co.
Jewell Elec'l. Instr. Co.
Graphic
General Electric Co.
Jewell Elec'l. Instr. Co.
Taylor Instrument Co.
Westinghouse Elec. & Mfg. Co.
Zernickow, O.
Indicating
General Electric Co.
Taylor Instrument Co.
Westinghouse Elec. & Mfg. Co.
Integrating
General Electric Co.
Sangamo Electric Co.
Portable
Westinghouse Elec. & Mfg. Co.
Recording
Westinghouse Elec. & Mfg. Co.
Scientific and Testing Service
General Electric Co.
Metropolitan Device Corp.
Westinghouse Elec. & Mfg. Co.

Insulating Machinery Wire
American Ins. Machinery Co.

Insulating Material
Asbestos
Johns-Manville, Inc.
Asbestos Ebony
Deceleco Co.
Composition Cloth & Paper
Irvington Varnish & Ins. Co.
Mica Insulator Co.
Westinghouse Elec. & Mfg. Co.
Compounds, Paints and Varnishes
Garfield Mfg. Co.
General Electric Co.
General Insulate Co.
Irvington Varnish & Ins. Co.
Mica Insulator Co.
Redmanol Chem. Prod. Co.
Westinghouse Elec. & Mfg. Co.
Fibre
Continental Fibre Co.
National Vule. Fibre Co.
Spaulding Fibre Co.
West Virginia Pulp and Paper Co.
Laminated, Phenolic Condensation Products
Continental Fibre Co.
Lava
American Lava Co.
Steward Mfg. Co., D. M.
Mica
Mica Insulator Co.
Munsell & Co., Eugene
Mica, Micarata
Westinghouse Elec. & Mfg. Co.
Molded
Bakelite Corp.
Cutler-Hammer Mfg. Co.
Garfield Mfg. Co.
Paper
Irvington Varnish & Ins. Co.
Silk
Irvington Varnish & Ins. Co.
Slate
Portland-Monson Slate Co.
Tape and Webbing
General Electric Co.
Mica Insulator Co.
Westinghouse Elec. & Mfg. Co.
Transite
Deceleco Co.
Treated Fabric and Paper
Westinghouse Elec. & Mfg. Co.
Untreated Fabric and Paper
Westinghouse Elec. & Mfg. Co.

Insulation, Electric
Bakelite Corp.
West Virginia Pulp and Paper Co.

Insulation, Molded
Bakelite Corp.

Insulator Equipment
Thomas & Sons Co., R.

Insulator Pins
Hubbard & Co.
Ohio Brass Co.
Thomas & Sons, R.

Insulators
High Voltage Porcelain
Electric Service Supplies Co.
Locke Insulator Corp.
Porcelain
Canadian Porcelain Co., Ltd.
Ohio Brass Co.
Porcelain Composition
Franklin Porcelain Co.
General Insulate Co.
General Porcelain Co.
Lapp Insulator Co., Inc.
Thomas & Sons Co., R.
Westinghouse Elec. & Mfg. Co.
Post Type
Delta Star Elec. Co.

Irons, Electric
Westinghouse Elec. & Mfg. Co.

Lamps
Arc
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Incandescent
General Electric Co.
Graybar Electric Co.
Westinghouse Elec. & Mfg. Co.
Miniature
General Electric Co.

Lamp Guards
Matthews Corp., W. N.

Lamp Replacers
Matthews Corp., W. N.

Lighting Equipment, Interior and Exterior
Westinghouse Elec. & Mfg. Co.

Lighting Fixtures, Outdoor
Line Material Co.

Lighting Standards
Bates Steel Corp., Walter

Lightning Arresters
Delta Star Elec. Co.
Electric Power Equip. Corp.
Electric Service Supplies Co.
Electrical Engineers' Equip. Co.
General Electric Co.
Hi-Voltage Equipment Co.
Hubbard & Co.
Pacific Elec. Mfg. Co.
Railway & Indus. Engr. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Line Material
Bethlehem Steel Co.
Electric Service Supplies Co.
G & W Elec. Spec. Co.
General Electric Co.
Hubbard & Co.
Line Material Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Linemen's Shields and Protectors
Linemen Protector Co.

Linemen's Supplies
Linemen Protector Co.

Locaters, Fault
Matthews Corp., W. N.

Locomotives, Diesel
American Brown Boveri Elec. Corp.

Locomotives, Electric
American Brown Boveri Elec. Corp.
Westinghouse Elec. & Mfg. Co.

Lugs
Sherman Mfg. Co., H. B.

Machines
Mining
Allis-Chalmers Mfg. Co.
Pipe Bending
American Pipe Bending Mach. Co.
Welding
Westinghouse Elec. & Mfg. Co.

Magnets
Dudlo Mfg. Co.

Meters
Demand
Westinghouse Elec. & Mfg. Co.
Kilovoltamperes
Westinghouse Elec. & Mfg. Co.
Watthour
Westinghouse Elec. & Mfg. Co.

Meter Testers
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Meters, Electric & Flow
(See Instruments, Electric & Boiler Room)

Molded Insulation
(See Insulation, Molded)

Molded Parts
Garfield Mfg. Co.

Molding Materials
Bakelite Corp.

Motor Generators
Westinghouse Elec. & Mfg. Co.

Motors
Allis-Chalmers Mfg. Co.
Baldor Electric Co.
Burke Elec. Co.
Century Electric Co.
General Electric Co.
Graybar Electric Co.
Lincoln Electric Co.
Marble Card Elec. Co., The
Reliance Elec. & Eng. Co.
Sturtevant Co., B. F.
Westinghouse Elec. & Mfg. Co.
Zobell Elec. Motors Co.
Mine
Westinghouse Elec. & Mfg. Co.
Railway
Westinghouse Elec. & Mfg. Co.
Small
Westinghouse Elec. & Mfg. Co.

Oil Burners
Babcock & Wilcox Co.

Oil Burning Systems
Bethlehem Steel Co.

Oil Engines
(See Engines)

Oil, Fuel
Empire Refineries, Inc.

Oil, Lubricating
Empire Refineries, Inc.

Packing
General Electric Co.

Painting Equipment, Mechanical or Electrical
Matthews Corp., W. N.

Panel Boards
General Electric Co.
Trumbull Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Panels, Switchboard
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Pavement Breakers, Pneumatic
Ingersoll-Rand Co.

Pins, Insulator
Hubbard & Co.

Pipe
Riveted Steel
Riter-Conley Co.

Pipe Frame Fittings, Electrical
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Platinum
Baker & Co., Inc.

Plugs, Attachment
General Electric Co.

Plugs, Attachment and Caps
Cutler-Hammer Mfg. Co.

Pole Line Hardware
Bethlehem Steel Co.
Electric Service Supplies Co.
Graybar Electric Co.
Hubbard & Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Poles, Reinforcing of
Hubbard & Co.

Poles
Cedar
Bell Lumber Co.
Graybar Electric Co.
Steel
Archbold-Brady Co.
Bates Steel Corp., Walter
Lehigh Structural Steel Co.
Milliken Bros. Mfg. Co.
Pacific Coast Steel Co.
Riter-Conley Co.
Wood
Hubbard & Co.

Porcelain
(See Insulating Material, China and Porcelain)
Westinghouse Elec. & Mfg. Co.

Potentiometers
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Potheads
G & W Elec. Spec. Co.

Preheaters, Air
Babcock & Wilcox Co.

Projectors, Floodlighting
Electric Service Supplies Co.
Westinghouse Elec. & Mfg. Co.

Protective Devices
Electric Power Equip. Corp.
General Electric Co.
Metropolitan Device Corp.
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Pulverized Fuel Equipment
Aero Pulverizer Co.
Bethlehem Steel Co.
Combustion Engineering Corp.
Furnace Engineering Co., Inc.
Power Spec. Co.
Riley Stoker Corp.

Pumping Systems, Air Lift
Ingersoll-Rand Co.

Pumps
Worthington Pump & Machy. Corp.
Boiler Feed
Bethlehem Steel Co.
Chicago Pump Co.
Ingersoll-Rand Co.
Lecourtenay Co.
Centrifugal
Allis-Chalmers Mfg. Co.
Bethlehem Steel Co.
Chicago Pump Co.
De Laval Steam Turbine Co.
Ingersoll-Rand Co.
Lecourtenay Co.
Power
Lecourtenay Co.
Reciprocating
Allis-Chalmers Mfg. Co.
Bethlehem Steel Co.

Pyrometers
Taylor Instrument Co.

Radio Apparatus
Cutler-Hammer Mfg. Co.
General Electric Co.
General Radio Co.

Racks, Cable
G. & W. Elec. Spec. Co.

Racks, Secondary
Hubbard & Co.

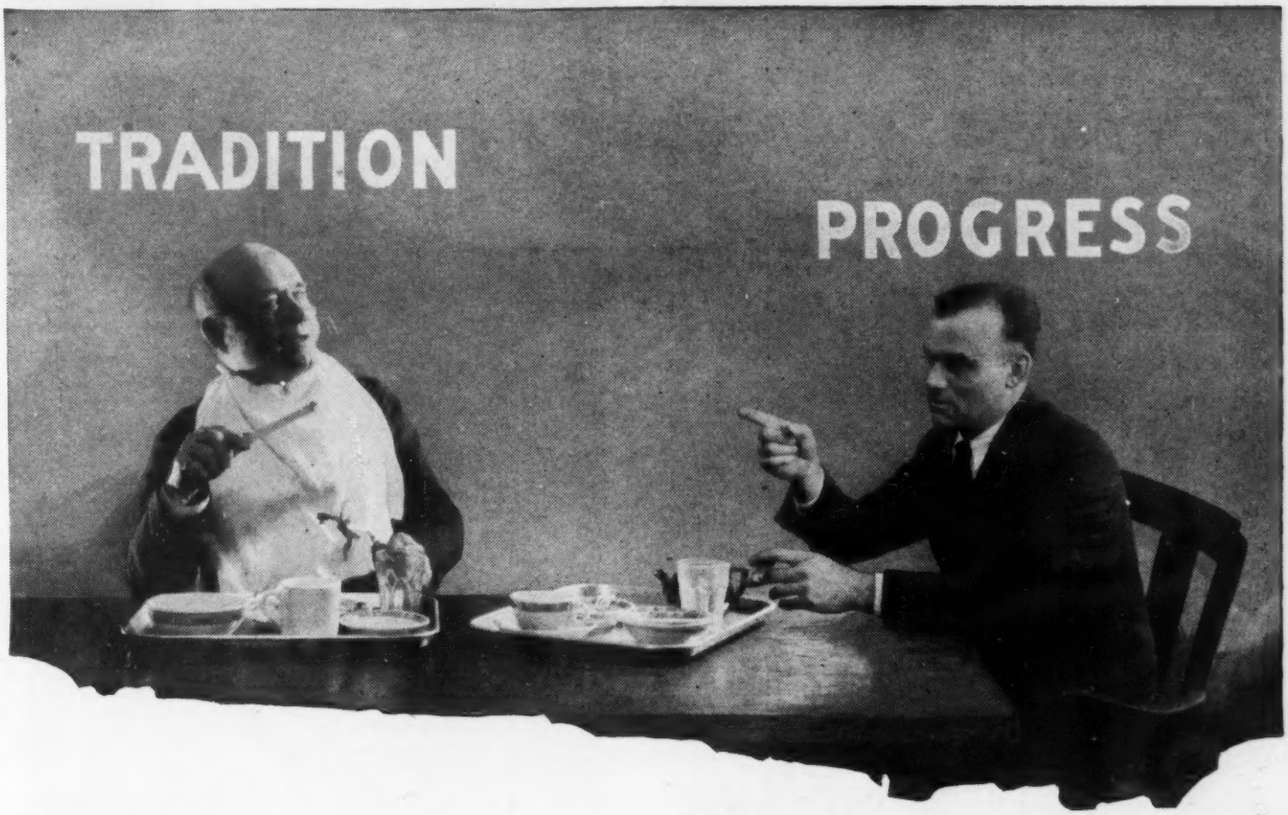
Rail Bonds
American Steel & Wire Co.
Ohio Brass Co.

Ranges, Electric
Westinghouse Elec. & Mfg. Co.

Rectifiers
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Rectifiers, Mercury Arc Power
American Brown Boveri Elec. Corp.

Lad Gives Pop Something to Chew on



"Lad,—

I'll have to admit that *in some cases* you can weld steel shapes together and get a stronger construction than cast iron and cheaper, too, but do you realize that it would cost us a *tremendous* lot of money, more than we've got, to make the flop—"

A new textbook on Arc Welding (Price $1.50) will be sent on approval for five days to any executive requesting it.
Book size, 6" x 9"—Total pages, 160—Number illustrations, 200—Charts, 62—Divisions, 8.

"No, Pop—

....You don't take electric welding as you do an oyster.

Sold as I am on Stable-Arc welding I wouldn't want to go in for it at one gulp.

All I ask is to acquire an olive-like taste for welding.

Put one Stable-Arc welder in a SHOW ME corner of the plant.

Then if it proves to be the glutton for production that our best factories claim for it—we'll put it on our cost cutting menu."

As an appetizer—get some recent bulletins from Dept. 1-12.

The Lincoln Electric Co., Cleveland, Ohio

WC-5

"Stable Arc"

LINCOLN WELDER

Reels, Take Up and Pay Out
Gleason & Co., J. L.
Matthews Corp., W. N.

Regulators, Automatic
American Brown Boveri Elec. Corp.

Regulators, Feedervoltage
Westinghouse Elec. & Mfg. Co.

Relays
Condit Elec'l. Mfg. Corp.
Westinghouse Elec. & Mfg. Co.

Repairing (See Searchlight Section)

Resistance Units
Allen-Bradley Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Monitor Controller Co.
Railway & Industrial Eng. Co.

Resistors
Westinghouse Elec. & Mfg. Co.

Re-Superheaters
Superheater Co.

Rheostats
Allen-Bradley Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Sundh Electric Co.
Westinghouse Elec. & Mfg. Co.

Rivets
Bethlehem Steel Co.

Rods, Brass, Copper & Bronze
American Brass Co.

Searchlights
General Electric Co.

Second-Hand Apparatus (See Searchlight Section)
Archer & Baldwin
Belyea Co., Inc.
Electric Service Co., Inc., The
Ellis, A. Lee
Empire Elec. Machy. Co.
Glow Electric Co.
Hall & Co., Inc., Stephen
Hemphill & Co., J. L.
Kansas City Power & Light Co.
Klein & Co., Nathan
Land, L. J.
Miller-Owen Electric Co.
Nashville Ind. Corp.
Nussbaum Co., V. M.
Power Machinery, Inc.
Power Plant Equip. Co., Inc.
Randle Machy. Co.
Ross Power Equip. Co.
Sachsenmaier Co., George
Scheinert Co., R.
Wayne Machinery Co.
Wilson Machinery Co., H. R.

Separators, Magnetic
Cutler-Hammer Mfg. Co.

Screws, Lag
Hubbard & Co.

Sheets
Copper, Bronze and Nickel Silver
American Brass Co.
Newport Rolling Mill Co.
Metal
Bethlehem Steel Co.

Silent Chain Drives
Morse Chain Co.

Slack Pullers
Matthews Corp., W. N.

Slate
Portland-Monson Slate Co.

Sockets and Receptacles
Cutler-Hammer Mfg. Co.
General Electric Co.

Solders
Westinghouse Elec. & Mfg. Co.

Soldering Flux
Westinghouse Elec. & Mfg. Co.

Solenoids (See Coils, Armatures, Field and Magnet)

Speed Reducers
Lipe, Inc., W. C.

Springs
American Steel & Wire Co.

Sprockets, Silent Chain
Morse Chain Co.

Staples
American Steel & Wire Co.

Insulated
Blake Signal & Mfg. Co.

Starters, Motor, Electric
Allen-Bradley Co.
Condit Elec'l Mfg. Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Industrial Controller Co.
Monitor Controller Co.
Sundh Electric Co.
Westinghouse Elec. & Mfg. Co.

Steam Specialties
Johns-Manville, Inc.

Steel, Electrical Sheets
Mansfield Sheet & Tin Plate Co.

Steel Fabrication
Bates Steel Corp., Walter

Steel Plate Work
Bates Steel Corp., Walter
Blaw-Knox Co.

Stokers
American Engr. Co.
Babcock & Wilcox Co.
General Electric Co.
Riley Stoker Corp.
Mechanical
American Engr. Co.
Combustion Engr. Corp.
Westinghouse Elec. & Mfg. Co.

Stoves (See Ranges)

Strainers, Oil
Bethlehem Steel Co.

Structural Steel
Bates Steel Corp., Walter
Bethlehem Steel Co.
Blaw-Knox Co.
Milliken Bros. Mfg. Co.

Structures, Steel
Bates Steel Corp., Walter

Substations, Complete Manual Automatic & Electro-Pneumatic Automatic
Westinghouse Elec. & Mfg. Co.

Sub-Stations, Outdoor
Delta Star Elec. Co.
Electric Power Equip. Corp.
Electrical Engineers' Equip. Co.
Ferranti Meter & Trans. Mfg. Co., Ltd.
General Electric Co.
Hi-Voltage Equipment Co.
Lehigh Structural Steel Co.
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.
Steel
Bates Steel Corp., Walter

Superheaters, Steam
Babcock & Wilcox Co.
Power Specialty Co.
Superheater Co.

Supplies (Electric Railway)
General Electric Co.
Graybar Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Switchboard Supplies
Electric Power Equip. Corp.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Switchboards
Allis-Chalmers Mfg. Co.
Condit Elec'l Mfg. Corp.
General Electric Co.
Graybar Electric Co.
Trumbull Electric Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Asbestos Wood
Johns-Manville, Inc.

Switch Houses
Condit Elec'l. Mfg. Co.

Switches
Air Break and Pole Top
Condit Elec'l Mfg. Corp.
Delta Star Elec. Co.
Electric Power Equip. Corp.
Electrical Engineers' Equip. Co.
General Electric Co.
Hi-Voltage Equip. Co.
Pacific Elec. Mfg. Co.
Railway & Industrial Engr. Co.
Schweitzer & Conrad, Inc.

Disconnecting
Delta Star Elec. Co.
Electric Power Equip. Corp.
Electrical Engineers' Equip. Co.
General Electric Co.
Hi-Voltage Equipment Co.
Matthews Corp., W. N.
Pacific Elec. Mfg. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Float
Cutler-Hammer Mfg. Co.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Sundh Electric Co.
Westinghouse Elec. & Mfg. Co.

Fuse
General Electric Co.
Matthews Corp., W. N.
Metropolitan Device Corp.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Horn Gap
Westinghouse Elec. & Mfg. Co.

Instrument
Westinghouse Elec. & Mfg. Co.

Knife
Condit Elec'l Mfg. Corp.
General Electric Co.
Trumbull Elec. Mfg. Co.

Magnetic
Allen-Bradley Co.

Oil
American Brown Boveri Elec. Corp.
Condit Elec'l Mfg. Corp.
General Electric Co.
Pacific Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Oil Disconnecting
G. & W. Elec. Spec. Co.

Open-Type
Matthews Corp., W. N.

Remote Control
Cutler-Hammer Mfg. Co.
General Electric Co.
Monitor Controller Co.
Sundh Electric Co.
Westinghouse Elec. & Mfg. Co.

Safety Enclosed
General Electric Co.
Trumbull Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Series
Cutler-Hammer Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Snap and Push Button
Cutler-Hammer Mfg. Co.
G & W Elec. Spec. Co.
General Electric Co.
Graybar Electric Co.

Time
General Electric Co.
Paragon Electric Co.
Westinghouse Elec. & Mfg. Co.

Synchroscopes
General Electric Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Tachometers
Zernickow, O.

Tanks
Riter-Conley Co.

Tape, Friction
Okonite Co.

Tape, Rubber
Okonite Co.
Westinghouse Elec. & Mfg. Co.

Telephones
Graybar Electric Co.
Westinghouse Elec. & Mfg. Co.

Terminal Lugs, Solderless
Dossert & Co.

Testing Apparatus
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Theatre Dimmers
Cutler-Hammer Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Toaster
Westinghouse Elec. & Mfg. Co.

Tools, Linemen's (See Linemen's Supplies & Tools)

Tools, Pneumatic
Ingersoll-Rand Co.

Towers
Radio
Bates Steel Co., Walter
Blaw-Knox Co.
Milliken Bros. Mfg. Co.
Riter-Conley Co.
Steel
Bates Steel Corp., Walter
Transmission
Aermotor Co.
Archbold-Brady Co.
Bates Steel Corp., Walter
Blaw-Knox Co.
Lehigh Structural Steel Co.
Milliken Bros. Mfg. Co.
Riter-Conley Co.
Truscon Steel Co.

Transformers
Allis-Chalmers Mfg. Co.
American Brown Boveri Elec. Corp.
Ferranti Meter & Trans. Mfg. Co., Ltd.
General Electric Co.
Kuhlman Electric Co.
Moloney Elec. Co.
Pacific Elec. Mfg. Co.
Packard Electric Co.
Pittsburgh Transformer Co.
Westinghouse Elec. & Mfg. Co.
Distribution
Kuhlman Electric Co.
Furnace and Special Types
Kuhlman Electric Co.
Instrument
Jewell Elec'l. Instr. Co.
Westinghouse Elec. & Mfg. Co.
Street Lighting
Kuhlman Electric Co.
Tripping and Metering
Condit Elec'l. Mfg. Corp.

Transformers, Bell Ringing
General Electric Co.
Metropolitan Device Corp.
Westinghouse Elec. & Mfg. Co.

Transmission, Silent Chain
Morse Chain Co.

Traps, Steam & Radiator
Johns-Manville Co.

Tubes, Copper, Brass, Bronze and Nickel Silver
American Brass Co.

Turbines
Hydraulic
Allis-Chalmers Mfg. Co.
American Brown Boveri Elec. Corp.
Leffel & Co., James
S. Morgan Smith Co.
Steam
Allis-Chalmers Mfg. Co.
American Brown Boveri Elec. Corp.
De Laval Steam Turbine Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Turbo-Generators
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg.

Underfloor Duct Systems
Johns-Manville, Inc.

Valves, Gate and Butterfly
S. Morgan Smith Co.

Varnish, Insulating
Bakelite Corp.

Vault Units, Oil Disconnecting
G. & W. Elec. Spec. Co.

Washers
Mass. Machine Shop

Washing Machines
Graybar Electric Co.

Water Walls, Furnace
Combustion Engr. Corp.

Waterwheels, Impulse Turbines
Allis-Chalmers Mfg. Co.
Leffel & Co., James, The

Water Wheel Generators
Westinghouse Elec. & Mfg. Co.

Water Wheel Governors
Woodward Governor Co.

Wattmeters, Watt Hour Meters (See Instruments)

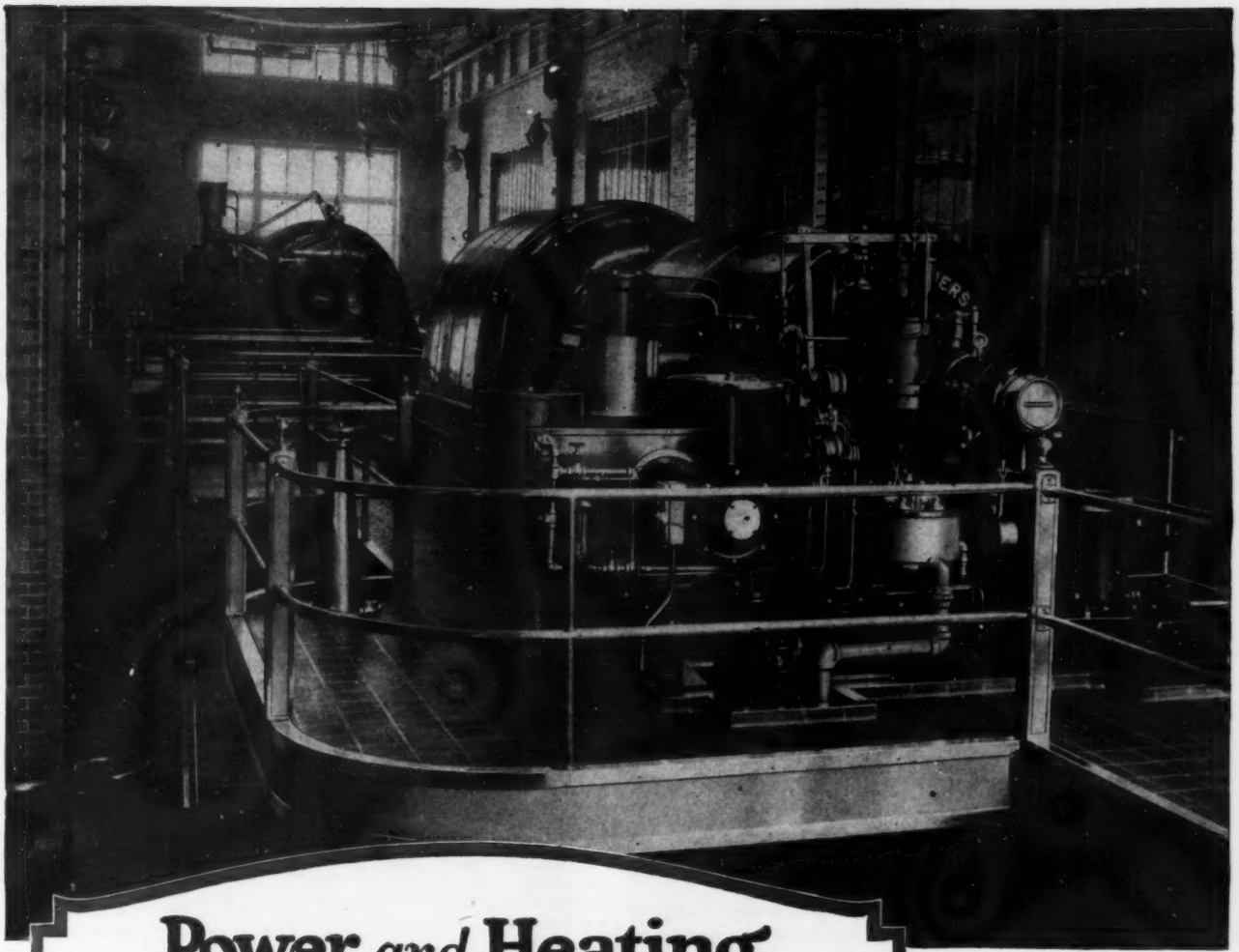
Welders
Arc
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.
Portable
Ohio Brass Co.

Welding Apparatus
Lincoln Electric Co.
Ohio Brass Co.

Welding Machines
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Wires and Cables
Aluminum
Aluminum Co. of America
Auto
American Steel & Wire Co.
Simplex Wire & Cable Co.
Automatic
Packard Electric Co.
Bare and Insulated
American Brass Co.
Standard Underground Cable Co.
Bare Copper
American Ins. Wire & Cable Co.
Phillips Wire Company
Copperweld
Copperweld Steel Co.
Grounds, etc.
Copperweld Steel Co.
Impregnated Paper
Okonite-Callender Cable Co.
Magnet
American Steel & Wire Co.
Rockbestos Products Corp.
Roebling's Sons, J. A.
Rome Wire Co.
Radio
Packard Electric Co.
Resistance
Driver-Harris Co.
General Electric Co.
Hoskins Mfg. Co.
Rubber Covered and Waterproof
American Ins. Wire & Cable Co.
American Steel & Wire Co.
Graybar Electric Co.
Okonite Co., The
Phillips Wire Company
Roebling's Sons Co., J. A.
Safety Cable Co.
Simplex Wire & Cable Co.
Solid and Stranded
American Brass Co.
Splicing Materials
Okonite Co.
Okonite-Callender Cable Co.
Steel
Bethlehem Steel Co.
Tree
Okonite Co., The
Underground (Cable)
American Steel & Wire Co.
Roebling Sons Co., J. A.
Simplex Wire & Cable Co.
Varnished Cambric
American Brass Co.
American Steel & Wire Co.
Okonite Co., The
Simplex Wire & Cable Co.
Weatherproof
American Brass Co.
Indiana Rubber & Ins. Wire Co.

Wireless Apparatus
General Electric Co.
Westinghouse Elec. & Mfg. Co.



Power *and* Heating Efficiently Combined

The Power Plant of the Ford factory at Ford City, Ontario, economically combines power production throughout the year with winter heating.

Allis-Chalmers Steam Turbine Units were chosen for this unusual combination.

The two units of 10,000 K.W. and 5,000 K.W. rating operate normally condensing but when heat is required the smaller unit operates with reduced vacuum, the warm circulating water delivering heat to the Plant.

Vacuum is reduced as heat requirements increase and provision is made for extracting additional steam from the larger unit during periods of severe cold. This arrangement meets heating requirements with a minimum of energy lost.

The turbine equipment making this high economy possible is the product of the Allis-Chalmers Organization, which is ready to serve you in any power problem. Additional details will be gladly furnished on request.

PRODUCTS:

Steam Turbines
Hydraulic Turbines
Electrical Machinery
Steam-Engines
Gas Engines
Condensers
Oil Engines
Pumping Engines
Centrifugal Pumps
Mining Machinery
Metallurgical Machinery
Crushing Machinery
Cement Machinery
Flour Mill Machinery
Saw Mill Machinery
Air Compressors
Air Brakes
Steam and Electric Hoists
Farm Tractors
Power Transmission Machinery
Timber Preserving Machinery

ALLIS-CHALMERS

MILWAUKEE, WIS., U. S. A.

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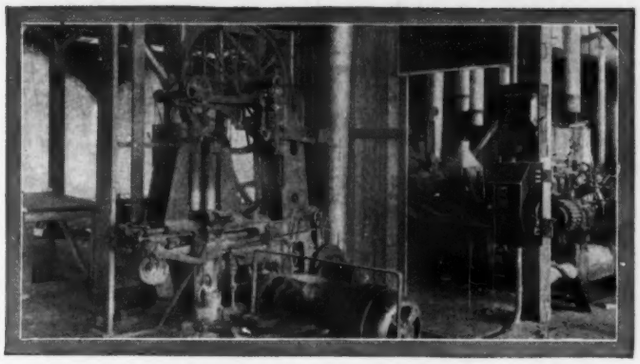

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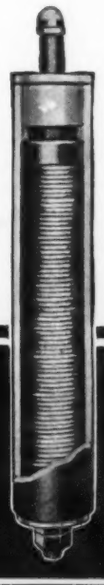

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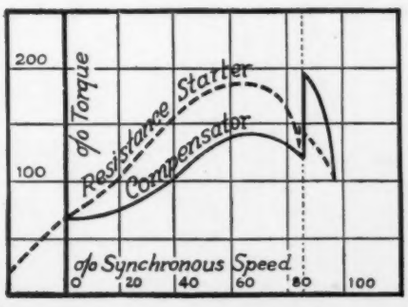

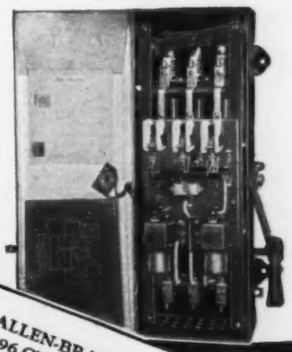

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